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VOL. XVIII.—1899.

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THE JOURNAL

OF THE

Society of Chemical Industry.

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 6.—Vol. XVIII.] JUNE 30, 1899. [Non-Members 30/- per annum; Members 21/- per Set of extra or back numbers; Single Copies (Members only) 2/6.

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NOTE.—The names in *italics* are those of Members of Committee who retire at the end of the current session.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR 1898. (Made up to the 23rd May 1899.)

REVENUE.

	£ s. d.	£ s. d.
Annual Subscriptions for 1898:—		
66 subscriptions received in 1897	82 9 0	
2,874 subscriptions received in 1898	3,591 15 0	
41 subscriptions received in 1899	51 5 0	
(Sundry balances of subscriptions)	1 13 3	
2,981		3,727 2 3
286 Entrance Fees	300 5 6	
1 Life Composition Fee	20 0 0	
Subscriptions received on account of the "Collective Index"	..	4 0 0
Investments:—		
Interest on Metropolitan 3 per cent. Consolidated Stock	129 16 4	
Interest on Gas Light and Coke Company's 3 per cent. Consol. Deb. Stock.	17 8 0	
Interest on North British Railway 3 per cent. Consolidated Debenture Stock.	31 9 2	
Interest on Midland Railway 2½ per cent. Perpetual Preference Stock	7 15 8	
Interest on Great Eastern Railway 4 per cent. Guaranteed Stock	25 5 8	
Interest on New Zealand 3 per cent. 1945 Stock	29 0 0	
Interest on New South Wales 3 per cent. 1935 Stock	14 1 4	
Interest on South Eastern Railway 4½ per cent. Preference Stock	14 12 9	
Interest on Deposit Account at Bank	19 18 11	
		299 7 10
Journal:—		
Advertisements	576 0 0	
Sales	369 9 1	
		945 9 1
		£4,975 19 2

EXPENDITURE.

	£ s. d.	£ s. d.	£ s. d.
Journal Expenses:—			
Publishing		1,828 18 9	
Editorial:—			
Editor's Salary	500 0 0		
Editor's Expenses	44 12 8		
Abstractors' Accounts	513 0 0		
Indexing Journal	78 12 0		
Patent Lists	73 12 9		
Foreign Journals	11 1 0		
Sundry Journals	2 12 9		
Portion of Secretary's salary	100 0 0		
		1,323 11 2	
Insurance of Stock		3 15 0	
			3,156 4 11
Printing Sundries			61 2 0
Sectional Expenses			363 15 3
Secretary's Salary (Portion not included in Journal Editorial Expenses)			350 0 0
Expenses in connection with "Annual Meeting"			170 1 8
Honorary Treasurer's Assistant			52 10 0
Stationery			30 2 0
Office Expenses			117 9 11
Library (Binding Books)			6 2 7
Auditors' Fee			10 11 6
"Collective Index" (Amount paid on Account of the Compilation)			20 0 0
Bank Charges			4 5 10
Transferring Stocks to New Trustees			10 2 0
Engraving Medal			0 8 6
Treasurer's Petty Cash			16 7 0
Secretary's Petty Cash			54 0 5
Balance of Revenue over Expenditure			552 15 7
			£4,975 19 2

THE TREASURER—IN ACCOUNT WITH THE SOCIETY OF CHEMICAL INDUSTRY FOR THE YEAR 1898.

Dr.

		£ s. d.	£ s. d.
To Cash on Deposit (1st January 1898)		500 0 0	
Balance at Bank (1st January 1898)		97 8 3	
Balance in Secretary's hands (1st January 1898)		10 10 4	
			607 18 7
Annual Subscriptions:—			
1 subscription for the year 1895		1 5 0	
4 subscriptions for the year 1896		5 0 0	
37 subscriptions for the year 1897		46 5 0	
2,874 subscriptions for the year 1898 (less 15*s*. short paid)		3,591 15 0	
72 subscriptions for the year 1899		90 0 0	
1 subscription for the year 1900		1 5 0	
1 subscription for the year 1901		1 5 0	
2,990			
Sundry excess payments and Balances of Subscriptions		7 8 6	
			3,744 3 6
Entrance Fees (286 at 1*l*. 1*s*., less 6*d*. short paid)		..	300 5 6
Life Composition Fees (1 at 20*l*.)		..	20 0 0
Subscriptions for "Collective Index"		..	4 0 0
Interest on Investments:—	£ s. d.		
Metropolitan 3 per cent. Consolidated Stock	(4,476 9 2)	129 16 4	
Gas Light and Coke Company's 6 per cent. Debenture Stock (300*l*.), converted into 3 per cent. Consolidated Debenture Stock	(600 0 0)*	17 8 0	
North British Railway 3 per cent. Consolidated Stock	(1,084 13 4)	31 9 2	
Midland Railway 4 per cent. Preference Stock (460*l*.) converted into 2½ per cent. Perpetual Preference Stock	(736 0 0)*	17 15 8	
Great Eastern Railway 4 per cent. Guaranteed Stock	(654 0 0)	25 5 8	
New Zealand 3 per cent. 1945 Stock	(1,000 0 0)	29 0 0	
New South Wales 3 per cent. 1935 Stock	(485 4 8)	14 1 4	
South Eastern Railway 4½ per cent. Preference Stock	(673 0 0)	14 12 9	
Total amount of Stocks held 31st Dec. 1898	(9,709 7 2)		
Deposit Account at Bank		19 18 11	
			299 7 10
Journal:—			
Advertisements		720 0 0	
Sales		378 7 5	
			1,098 7 5
			£6,074 2 10

* December 1898.

Cr.

	£ s. d.	£ s. d.	£ s. d.
By Journal Expenses:—			
† Publishing		2,137 2 11	
Editorial:—			
Editor's Salary	500 0 0		
Editor's Expenses	45 8 5		
Abstractors' Accounts	456 4 4		
Patent Lists	70 18 3		
Indexing Journal	76 18 0		
Foreign Journals	11 1 0		
Sundry Journals	3 2 9		
Portion of Secretary's Salary	100 0 0		
		1,263 12 9	
Insurance of Stock		3 15 0	
			3,404 10 8
Printing Sundries			66 17 6
Sectional Expenses:—			
Liverpool Section		31 11 0	
London Section		110 0 7	
Manchester Section		54 19 7	
Newcastle Section		9 5 10	
New York (U.S.A.) Section		77 8 0	
Nottingham Section		21 8 3	
Scottish Section		45 11 5	
Yorkshire Section		13 10 7	
			363 15 3
Secretary's Salary (Portion not included in Journal Editorial Expenses)			350 0 0
"Annual Meeting" (Expenses in connection with)			170 1 8
Honorary Treasurer's Assistant (for work in 1897)			53 10 0
Stationery			40 4 0
Office Expenses:—			
Rent		95 0 0	
Cleaning, Light, and Sundries		22 9 11	
			117 9 11
Library (Binding Books)			0 2 0
Auditors' Fee			10 11 6
Purchase of South Eastern Railway 4½ per cent. Preference Stock (673*l*.)			1,102 0 9
Engraving Medal			0 8 6
Expenses of transferring Stocks to New Trustees			10 2 0
Bank Charges			4 5 10
"Collective Index" Expenses			20 0 0
Treasurer's Petty Cash			16 7 0
Secretary's Petty Cash			54 0 5
Balance at Bank (31st December 1898)		283 1 9	
Balance in Secretary's hands (31st December 1898)		6 14 1	
			289 15 10
			£6,074 2 10

† Ten months only—Nov. 1896 to Aug. 1897 inclusive.

We have compared the above Statement with the Vouchers, Counterfoils of the Receipts issued, and other records, and are of opinion it correctly exhibits the Cash transactions of the Society for the year 1898. The amounts of the Metropolitan 3 per cent. Consolidated, 3 per cent. New Zealand, and 3 per cent. New South Wales Stocks have been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected, and the Bank Balance has been certified to us by the Bankers.

23, St. Swithin's Lane, London, E.C.,
23rd May 1899.

(Signed) MIALL, WILKINS, RANDALL, & Co.,
Chartered Accountants.

NOTICES.

Annual General Meeting.

The Annual General Meeting will be held in Newcastle on the 12th, 13th, and 14th July next. The Programme and Ticket of Membership were issued under separate cover. Those intending to take part in the meeting should make immediate application for tickets.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those Members whose names are placed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Prof. C. F. Chandler (New York) has been nominated to the office of President; Mr. George Beilby has been nominated Vice-President under Rule 11; and Mr. R. Forbes Carpenter, Mr. B. E. R. Newlands, and Mr. R. C. Woodcock have been nominated Vice-Presidents under Rule 8.

The Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Mr. E. Grant Hooper, Mr. J. M. C. Paton, Dr. F. B. Power, and Dr. W. S. Squire have been nominated, under Rules 18 and 19, to fill four vacancies among the Ordinary Members of Council.

Collective Index.

The Collective Index is now ready for delivery to Members, and will be posted to all those who have already subscribed in the course of a few days.

The prices are as follows:—

To Members (see Rules 25 and 27) and Past Members (see Rule 30); Libraries, Corporations, and Exchanges on the Society's List.	Each copy	10*s.*
To Subscribers....................	„	12*s.* 6*d.*
To others..........................	„	15*s.*

Hurter Memorial Lecture Fund.

The circular of the Liverpool Section in reference to the above Fund is enclosed with the present number of the Journal. A sum of at least 300*l.* is required for the endowment of the lecture. Subscriptions are payable to Eustace Carey, Treasurer, 30, James Street, Liverpool.

A Photogravure of the late Alfred Nobel, to illustrate Mr. H. de Mosenthal's paper (1899, 443—451), is issued herewith.

LIST OF MEMBERS ELECTED 23rd JUNE 1899.

Adrot, Léon, 51, Route d'Aubervillier, Pantin (Seine), France, Chemist.

Alexander, D. Basil W., Alcatraz Landing, Sta. Barbara Co., Cal., U.S.A., Chemist.

Appleby, C. W., Farnworth, near Widnes, Lancashire, Pith and Size Manufacturer.

Baker, H. Fenimore, c/o General Chemical Co., 32, Liberty Street, New York, U.S.A., Chemist.

Campbell, J. Eunyce, 11, Woodland Street, Cheetham Hill, Manchester, Chemical Engineer.

Collis, Walter T., Swinford House, Stourbridge, Worcestershire, Chemist.

Dreyfus, Dr Wm., c/o The West Disinfecting Co., 208, E. 52nd Street, New York, U.S.A, Chemist.

Harvey, Charles, c/o The Patent Borax Co. Ltd., Ledsom Street, Ladywood, Birmingham, Manufacturing Chemist.

Hawdon, H. S., Hedworth Barium Works, East Jarrow-on-Tyne, Manager.

Howlden, H. Linley, Royal Works, Sheffield, Managing Director (Mappin and Webb).

Karas, J., c/o Tim and Co., Troy, N.Y., U.S.A., Laundryman.

Loos, Hermann A., 119, East 115th Street, New York, U.S.A., Fellow in Chemistry of Columbia University.

Mappin, J. Newton, Headley Park, near Epsom, Chairman of Mappin and Webb, Ltd.

Margetson, J. Charles, Struan, Wexford Road, Wandsworth, S.W., India-Rubber Manufacturer.

Mellors, Paul, Minas Crispin, La Majada, Campofrio, Prov. de Huelva, Spain, Mine Manager.

Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.

Millar, Jas. H., c/o P. J. Petersen and Co., P.O. Box 38, Cape Town, South Africa, Laboratory Manager.

Murray, Jas. J., c/o Mountain Copper Co., Ltd., Iron Mountain, Shasta Co., Cal., U.S.A., Mining Engineer.

Potter, Chas. A., 198, Waterman Street, Providence, R.I., U.S.A., Chemist.

Riley, Walter A., jun., c/o John Heron, 110, Fenchurch Street, E.C., Brewer.

Stevenot, G. A., c/o The Stone and Ware Co., 157, Maiden Lane, New York, U.S.A., Chemist.

Stone, T. F., 157, Maiden Lane, New York, U.S.A., Chemical Merchant.

Williamson, G. N., 14, Dey Street, New York, U.S.A., Manufacturing Chemist.

CHANGES OF ADDRESS.

Allen, W. W., l/o Colorado; Room 1122, 30, Broad Street, New York City, U.S.A.

Bachke, A. Anker, l/o Röros; Ringoe, pr. Trondhjem, Norway.

Badock, Stanley H., l/o Clifton; 41, Downleaze Road, Stoke Bishop, near Bristol.

Ballard, E. G., l/o Newton Lane; Greenfield Cottage, Hoole Road, Chester.

Barnes, E. A.; Journals to Modderfontein, near Zuurfontein, S.A.R.

Benfey, Dr. Hans, l/o Upper Brook Street; 2, Sunnyside Terrace, Clayton, Manchester.

Bult, Herb. J., l/o Thames Haven; 165, Brixton Hill, S.W.

Chance, A. M.; Journals to Chemical Works, Oldbury, near Birmingham.

Charlier, A. C. J., l/o Greenock; Sussex House, Hill Street, Glasgow.

Clayton, J. W., l/o Aigburth; Bentfield, Hunt's Cross, Liverpool.

Cohen, Dr. Hermann, l/o Koln; 8, Beatengasse III, Zurich, Switzerland.

Colquhoun, W., l/o Victoria Road; 6, Grove Road, Wrexham.

Dakin, H. D., l/o Caledonian Road; 9, Beech Grove Terrace, Leeds.

De Lessing, G. C., l/o New York; 12, Woburn Place, Russell Square, W.C.

Dewar, A. H., Journals to Russian Steam Oil Mills, 32, Kourlandsky Street, St. Petersburg.

Greenway, T. J., l/o College Park; Second Avenue, St. Peters, Adelaide.

Haddow, G., l/o Glasgow; Nobel's Explosives Co., Perranporth, R.S.O., Cornwall.

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CHANGE OF NAME.

Heyl, J. Edw.; Heyl-Dia, G. Edw.; address as before.

Deaths.

Andreasch, F., Professor an der k.k. Versuchs Anstalt für Leder-Industrie in Wien, Austria. June 14.

Cox, Robt., M.P., of Gorgie, Edinburgh. June 1.

Reynolds, Lt.-Col. H. C., Thorncliff, Cheltenham. May 1.

Riley, John, Founder of Messrs. John Riley and Sons, Hapton, Accrington. June 24.

London Section.

Meeting held on Monday, June 5th, 1899.

MR. BOVERTON REDWOOD IN THE CHAIR.

A NEW METHOD FOR THE ANALYSIS OF COMMERCIAL PHENOLS.

BY S. B. SCHRYVER, D.SC., PH.D.

THE methods hitherto adopted for the estimation of phenols may be divided into three classes, depending on—

I. The precipitation of bromine derivatives.
II. The precipitation of iodine derivatives.
III. Direct titration with alkalis.

I. The earliest method under the first heading is that suggested by Landolt (Berichte, IV., 770), and consisted simply in the precipitation of the phenol by bromine. In the case of ordinary phenol, the compound precipitated has a composition corresponding with the formula $C_6H_2Br_4O$. This older method has since undergone various modifications, suggested by Koppeschaar (Zeits. f. analyt. Chem. **25**, 162), Weinreb and Bondi (Wiener Monatsheft f. Chem. **6**, 506), Kossler and Penny (Hoppe Seyler's Zeit. f. physiol. Chem. **17**, 133), Toth (Zeit. f. analyt. Chem. **25**, 162). The method adopted by Koppeschaar has become standard, and originally consisted in adding to an aqueous solution of the phenol, a solution of bromine in caustic soda in the presence of hydrochloric acid. After standing for some time, the excess of bromine is estimated by the addition of potassium iodide, and the titration of the iodine thus set free by standard thiosulphate solution. The reactions taking place may be represented by the equations:—

$$C_6H_5OH + Br_8 = C_6H_2Br_4O + 4HBr.$$
$$C_6H_2Br_4O + 2KI = C_6H_2Br_3OK + KBr + I_2.$$

It will be seen, therefore, that each molecule of phenol will correspond to six, and not eight atoms of bromine, the tetrabromophenol originally precipitated being partially decomposed by the potassium iodide.

The method of Koppeschaar has since been modified in various smaller details. Giacosa (Zeits. f. physiol. Chem. **6**, 45) adds bromine water to an aqueous solution of the phenol, until the supernatant liquid commences to turn starch-potassium iodide paper blue. Chandelon (Bull. Soc. Chim. **38**, 75) adds a dilute phenol solution to potassium hypobromite solution until the liquid no longer acts on starch potassium iodide paper. (Compare also Seubert, Jahresbericht der Chem. 1881, 1204.)

II. Messinger and Vortmann (Ber. XXII., 2313) have shown that when iodine dissolved in potassium iodide is added to a strongly alkaline solution of a phenol warmed to 50°—60° C., coloured iodine compounds of a characteristic nature are formed. Ordinary phenol gives a product the composition of which corresponds to the formula $C_6H_3I_3O$. Thymol and other phenols give analogous compounds. By estimating the amount of iodine absorbed by various phenols, Messinger and Vortmann have devised a quantitative method for their estimation, which seems to have a fairly general application (Ber. XXIII., 2753). (Compare G. Kossler and Penny, Zeits. f. physiol. Chem. **17**, 126.)

III. Bader (Zeits. f. analyt. Chem. **31**, 58) estimates phenol by direct titration with normal caustic soda, using trinitrobenzene as an indicator. Most phenols, however, give strongly coloured solutions when dissolved in alkalis, and this method has accordingly only a very limited application, and needs no further discussion.

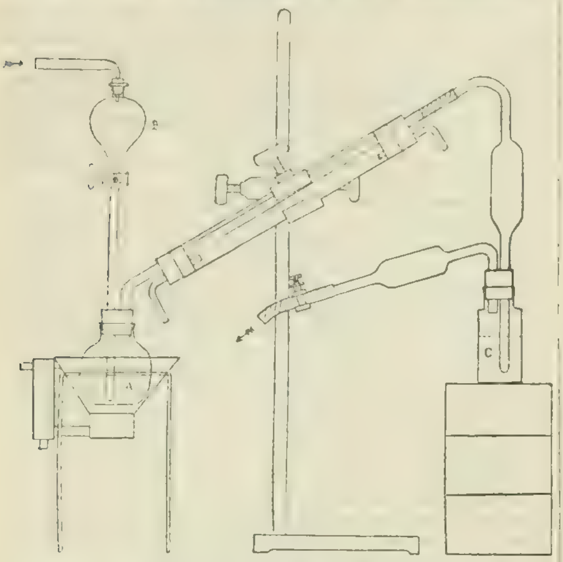
The methods hitherto generally adopted for estimating phenols fall then entirely under the first two headings. They have been subjected to criticism by Kleiner (Zeit. f. analyt. Chem. **23**, 13), and more recently by Mr. Carl E. Smith in a detailed report to a committee of the United States Pharmacopœia (Amer. Journ. Pharm., August 1898). The principal objection to their employment lies in the fact that a serious error occurs when the phenols are mixed even with small quantities of bodies capable of absorbing bromine or iodine, such as the hydrocarbons. This source of error is especially marked in the cases where an attempt is made to estimate the relative proportions of phenols in mixtures, such as phenol and the cresols, when the constituents only differ very slightly from one another in molecular weight, and also in attempting to estimate the amount of a phenol present in certain essential oils containing varying quantities of hydrocarbons, such as oil of thyme and oil of cloves.

Method and Apparatus.—A. W. Titherley (Trans. Chem. Soc. 1894, **66**, 504) described a few years ago a method by which the reagent sodium amide, $NaNH_2$, could be prepared pure and in considerable quantities without difficulty, and noted at the same time some of its reactions. Amongst others, it is known that it is capable of acting on bodies containing the hydroxyl group, replacing the hydrogen by sodium, evolving at the same time ammonia. Its action on water, alcohol, and phenol may be represented respectively by the three following equations:—

$$NaNH_2 + H_2O = NaOH + NH_3;$$
$$NaNH_2 + C_2H_5OH = NaOC_2H_5 + NH_3;$$
$$NaNH_2 + C_6H_5OH = NaOC_6H_5 + NH_3.$$

It is thus evident that for every hydrogen atom replaced in this way one molecule of ammonia is evolved. The principle of the method herein proposed consists in the treatment of a phenol in a solution of a substance having no action on sodium amide by an excess of this reagent, and estimating the ammonia evolved by the ordinary volumetric methods. Benzene was the liquid usually employed, and the apparatus is diagramatially figured in the adjoining sketch.

The sodium amide (about 1 grm.) is finely ground, and washed two or three times by decantation with small quantities of benzene, and introduced into a 200 c.c. wide-mouthed flask (A), connected with an inverted condenser. About 50 or 60 c.c. of benzene, free from thiophen, is added, and the mixture is then boiled on a water-bath, while a current of dry air (free from CO_2), drawn by means of an aspirator or water-pump through a separating funnel (B), which dips under the surface of the liquid, is continually sucked through the apparatus. This boiling is continued for some 10 minutes, so as to draw off the last traces of ammonia which adhere to the amide. About 20 c.c. of normal sulphuric acid are then introduced into the ammonia absorption bottle (C), and the phenol dissolved in about six times its weight of benzene is introduced into the separating funnel. This is then allowed to drop slowly into the sodium amide and benzene mixture, which is kept the whole time in a state of constant ebullition, and connected with the aspirator or water-pump. As soon as the phenol has been all added, the funnel is washed with a little more benzene, and air is aspirated through the apparatus until no more ammonia remains unabsorbed. The benzene holds the ammonia somewhat pertinaciously, and 1¼ hour is generally required before the former is entirely driven out. Enough phenol is generally employed to require from 10—17 c.c. normal sulphuric acid for complete neutralisation of the ammonia evolved. At the end of the operation the excess of sulphuric acid is estimated by titration with normal sodium carbonate, methyl orange being generally used as indicator. In this way the total amount of ammonia evolved is readily estimated. The error in the titration should not deviate more than $\frac{2}{10}$ c.c. from the theoretical amount required. In order to obtain accurate results, the following special precautions must be observed:—



(i.) Both the phenol and the apparatus should be perfectly free from moisture, as water acts on sodium amide (see above). The methods of freeing the phenol from moisture will be discussed in detail below.

(ii.) Sufficient benzene must be employed. As some of the sodium salts formed are very insoluble in benzene, the apparatus is apt to become clogged unless a fairly large quantity of this liquid is employed.

(iii.) The benzene should be free from thiophen, otherwise minute quantities of sulphur compounds are apt to be carried over, which interfere with the delicacy of the indicator.

(iv.) Air should be aspirated through the apparatus for a sufficient length of time.

Xylene or toluene can be employed in the place of benzene, but in these cases a sand-bath instead of a water-bath must be employed. In some of the results given below, xylene or toluene were the liquids used.

Quantity of substance taken.	Substance.	H_2SO_4 required for neutralisation of NH_3 evolved.	Quantity of substance found.	Error.
Grm.		C.c.	Grm.	
1·05	Phenol (pure)	11·2	1·05	0·00
1·03	„	10·7	1·05	+ 0·02
1·03	„	11·0	1·03	0·00
1·03	„	10·7	1·00	− 0·03
1·61	Cresol (ortho)	15·1	1·63	+ 0·02
2·08	Thymol	13·9	2·08	0·00
2·08	„	14·0	2·10	+ 0·02
2·09	„	13·7	2·05	− 0·04
2·09	„	13·6	2·04	− 0·05
2·09	„	13·7	2·05	− 0·04
2·09	„	14·0	2·10	+ 0·01
2·05	Guaiacol (cryst.)	16·4	2·03	− 0·02
2·06	„	16·6	2·06	0·00
2·06	„	16·6	2·06	0·00
2·06	„	16·5	2·05	− 0·01
2·06	„	16·4	2·03	− 0·02

Special Applications of the Method.

The Determination of the Relative Proportions of Different Phenols in Mixtures.

The method is, of course, not applicable to the determination of the relative proportions of more than two phenols. To test the method, mixtures were made of pure phenol and pure cresol in known proportions to imitate the commercial carbolic acids. A series of experiments yielded the following results:—

—	Amount of Cresol.	Amount of Phenol.	H_2SO_4 required to neutralise NH_3 evolved.	Theoretical amount of H_2SO_4 required.	"Hydroxyl" Value.
(*a*)	1·130	0·335	13·7 c.c.	13·5 c.c.	9·35
(*b*)	0·949	0·497	14·0 „	13·8 „	9·68
(*c*)	0·694	0·570	12·5 „	12·4 „	9·88
(*d*)	0·618	0·858	15·1 „	14·9 „	10·23

By the "hydroxyl value" is meant the number of c.c. of standard sulphuric acid solution that are necessary to neutralise the ammonia given off when 1 grm. of the substance (either simple substance or mixture) is treated with an excess of sodium amide under the conditions of an experiment. The hydroxyl value of pure phenol would be, therefore, $\frac{100}{9·4}$ or 10·63, that of pure cresol $\frac{100}{10·8}$ or 9·26, that is to say, the ammonia given off by 1 grm. of phenol would require 10·63 c.c. for neutralisation, that given off by the corresponding amount of cresol 9·26. Mixtures of phenol and cresol would have values lying between these two limits. A table is subjoined giving this hydroxyl value for various mixtures of phenol and cresol, and it will be seen that an error of about 0·1 in this value can cause an error of about 10 per cent. in the relative proportions of the phenol and cresol. Whilst, therefore, the method gives a fairly accurate estimation of the total phenols present, only a rough approximation is obtainable of the relative proportions of such mixtures as phenol and cresol, where the difference in the molecular weights is small.

Percentage of Phenol.	Percentage of Cresol.	Hydroxyl Value.
100	0	10·63
90	10	10·49
80	20	10·35
70	30	10·21
60	40	10·08
50	50	9·92
40	60	9·76
30	70	9·67
20	80	9·53
10	90	9·37
0	100	9·26

In the examples of mixtures analysed, the relative proportions taken of phenol and cresol respectively are approximately (*a*) 20 and 80, (*b*) 35 and 65, (*c*) 45 and 55, (*d*) 20 and 80 per cent. From the "hydroxyl" values found, the relative proportions as read from the above table are (*a*) 10 and 90, (*b*) 30 and 70, (*c*) 45 and 55, (*d*) 30 and 70 per cent. A commercial carbolic acid analysed gave the following result: 1·50 grm. gave off NH_3, requiring 15·5 c.c. H_2SO_4 for neutralisation. Hydroxyl value found, 10·33.

This corresponds to 80 per cent. phenol, 20 per cent. cresol.

Guaiacol from Wood Tar.—Guaiacol from wood tar is a liquid containing a mixture of guaiacol C_6H_4 (OH) (OCH_3) and creosol $C_6H_3(CH_3)(OH)(OCH_3)_2$, two homologues which cannot be entirely separated by fractional distillation (Mendelsohn, Dissertation, Berlin, 1877). The respective boiling points of these two bodies are 205·1° C. and 221°—222° C. In order to test the method of analysis, a sample of wood tar guaiacol was fractionated, and the separate fractions analysed to determine the relative proportions of phenol and creosol.

Boiling Point of Fraction.	Percentage.
204—205	17·7
205—206	14·6
206—207	11·4
207—208	12·9
208—209	11·3
209—210	6·6
210—211	6·0
211—212	6·0
212—214	5·0
214—216	6·6

It was observed that the sample contained small quantities of water, which pertinaciously distilled over, with even some of the higher fractions. Each fraction was therefore analysed, both as originally obtained, and after drying over fused sodium sulphate for several days. It will be shown that this drying reagent only removes the last traces of moisture with very great difficulty. The results, however, show a clear gradation in the composition of the fractions as we pass from the lower to the higher.

Undried Fractions.

Boiling Point.	Amount of substance taken.	H_2SO_4 used.	Hydroxyl Value.
204—205	1·45	13·6 c.c.	9·35
205—206	1·65	15·3 „	9·27
206—207	1·82	15·5 „	8·52
207—208	1·66	14·1 „	8·49
208—209	1·61	13·4 „	8·32
209—210	1·84	14·9 „	8·37
210—211	1·97	16·5 „	8·38
211—212	2·29	18·6 „	8·18
212—214	2·20	17·0 „	7·73

Fractions dried.	Quantity used.	H_2SO_4 for neutralisation.	Hydroxyl Value.
204—205	2·26	18·4 c.c.	8·14
205—206	2·10	17·2 „	8·19
206—207	2·15	17·4 „	8·09
207—208	1·60	13·0 „	8·09
208—209	2·11	16·4 „	7·77
209—210	1·65	12·5 „	7·57
210—211	2·08	15·9 „	7·64
211—211	1·82	14·0 „	7·68
212—214	1·42	10·7 „	7·53
214—216	1·62	12·0 „	7·41

Hydroxyl value for creosol	7·25
„ „ guaiacol	8·05

From the above table, it will be seen that the fractions up to 208 contain very small amounts of the higher homologue. The fractions 208—211 are of nearly constant composition, and contain about equal parts of guaiacol and creosol, whilst the highest fraction contains about 80 per cent. of the higher homologue. It will also be observed that the amount of water decreases rapidly after the two lowest fractions. The above tables indicate sufficiently how the composition of a mixture may be ascertained by this method of analysis.

Estimation of Thymol in Oil of Thyme.—For the purpose of control, an artificial mixture was first made by dissolving thymol in oil of turpentine.

A mixture weighing 8·087 grm., containing 2·183 grm. of thymol, gave off NH_3, requiring 14·8 c.c. H_2SO_4 for neutralisation.

Percentage of thymol taken, 26·9. Percentage found, 27·4.

Three commercial oils, designated as first, second, and third quality, were then analysed:—

First quality:—	
2·35 grm. undried, required	8·5 c.c. H_2SO_4
2·19 „ dry, „	5·5 c.c.
Percentage of thymol found	37·6
„ water „	2·4
Second quality:—	
2·48 grm., dried, required	4·3 c.c. H_2SO_4
2·35 „ undried, required	7·7
Percentage of thymol found	26·0
„ water „	1·8
Third quality:—	
2·35 grm., dried, required	3·1 c.c. H_2SO_4
2·31 .. undried, required	7·6
Percentage of thymol found	19·8
„ water „	2·3

Estimation of Eugenol in Oil of Cloves.—For the purpose of control, an artificial mixture was first prepared by dissolving some pure eugenol in oil of turpentine.

A mixture weighing 11·58 grm. containing 1·90 grm. eugenol required for neutralisation of NH_3 evolved 11·6 c.c. H_2SO_4.

Percentage of eugenol taken..................	16·4
„ „ found	16·4

2·41 grm. of a sample of oil of cloves required 12 c.c. H_2SO_4 to neutralise NH_3 evolved.

Amount of eugenol present = 1·87 grm., corresponding to 77·7 per cent.

Estimation of Water in Phenols.—It has several times been mentioned above that the method is applicable to the estimation of moisture in phenols. A series of experiments was carried out with pure phenol to estimate the accuracy of the method, and to determine what water-withdrawing agents were best suited for the purpose. The phenol was always dried in benzene solution. Ordinary phenol combines with water of crystallisation, and is on this account somewhat difficult to thoroughly dry. It was found that fused sodium sulphate removes the last one per cent. of moisture only very slowly. Fused sodium acetate is, however, well adapted for the removal of the last traces of moisture.

Copper sulphate, on the other hand, partly combines with the phenol.

Experiments—

(*a.*) 1·176 grm. phenol containing0 ·022 grm. moisture required 14·0 c.c. H_2SO_4 to neutralise the NH_3 evolved; 1·175 grm. dry should require 12·5 c.c.

The amount of water found as calculated from experiment = 0·02 grm.

(*b.*) 1·153 grm. of phenol with 0·041 grm. water were dissolved in benzene and dried over fused Na_2SO_4 and allowed to stand three days.

13·6 c.c. H_2SO_4 were required to neutralise the NH_3 evolved.

Theoretical quantity for 1·153 grm. phenol alone = 12·3. The phenol still contained after standing over Na_2SO_4 0·023 grm. moisture.

(*c.*) 1·154 grm. phenol containing 0·039 grm. water were allowed to stand in benzene solution over fused Na_3SO_4 three days.

H_2SO_4 required to neutralise NH_3 evolved = 13·5 c.c. 1·154 grm. phenol requires 12·2.

Amount of water still in phenol = 0·023 grm.

Potassium carbonate forms a compound with phenol, and cannot therefore be used as a drying agent.

(*d.*) 1·108 grm. phenol with 0·055 grm. water were allowed to stand *one night* over fused sodium acetate.

H_2SO_4 required to neutralise NH_3 evolved = 11·6 c.c.

Theoretical for 1·108 grm. phenol = 11·7.

Sodium acetate is therefore a suitable drying agent.

(*e.*) 1·030 grm. phenol with 0·044 grm. water after standing over anhydrous $CuSO_4$ required 7 c.c. to neutralise NH_3 evolved.

1·030 grm. phenol require 10·9 c.c.

Another experiment gave a similar result.

Copper sulphate evidently, therefore, partly combines with the phenol.

This method for estimating phenols has perhaps a wider application than any of the previously employed processes, owing to the fact that the result is not interfered with by the presence of hydrocarbons. For this reason it can be applied to the estimation of phenols in a large number of essential oils, &c. Sodium amide also acts on ketones, amines, &c. (*vide* Titherley, Trans. Chem. Soc. 1897, 460). These bodies, however, can be readily separated from phenols by various reagents, such as sodium bisulphite, acids, &c.

A large number of the analyses detailed in the above paper were carried out by Mr. R. W. Kennedy.

Discussion.

The Chairman, in inviting discussion on the paper, said the process appeared to him to be not only of scientific interest, but possibly also of practical value. Perhaps its weak point was the necessity for completely separating water from the phenol under examination, and it would be interesting to learn what method the author had found best for that purpose. He would also like to know what practical experience the author had had in the application of his process.

Dr. J. Lewkowitsch said that the method was certainly a very neat one, but did not go to the real root of the question, which was the determination of phenol in the presence of cresols. When making carbolic acid on a large scale in a tar works, he had used the Koppeschaar method, which was satisfactory enough as far as it went, but it did not differentiate between the cresols; indeed, it was the presence of these bodies which was the general difficulty of processes for the accurate determination of phenol in commercial products.

Dr. Rideal failed to see how this process gave one much advantage over the older methods, seeing that the molecular weight of the cresols was so near to that of phenol that differentiation would hardly give one the means of determining the actual quantity of each. Moreover, one would require much practice with the process before being certain of evolving the whole of the ammonia. In other methods in which condensation took place with ammonia, it was difficult to remove the whole of the remainder by distillation; and unless the distillation were carried on so as to effect this, errors would result. The author's remarks with regard to copper sulphate were, he knew, borne out by the experience of many workers.

Mr. A. R. Ling said he presumed Dr. Schryver's aim had been to establish the validity of the method for giving what might be termed the hydroxyl value of a phenol. To obtain an idea of the phenols present in a commercial mixture by the method, it would be obviously necessary not only to insure perfect drying of the mixture, but also to remove from it all substances other than phenols; or, assuming them to be inert, to ascertain their amount.

Mr. O. Hehner looked upon every addition to the existing methods for the examination of phenol which involved a new idea, as a valuable acquisition. In the case of pure phenol, the new method would allow of the estimation of the percentage; in the case of a mixture of phenol and its homologues, neither Dr. Schryver's nor any of the present known methods would permit of accurate determination of the actual phenol. In a mixture, for instance, of phenol with di- or trihydroxylbenzols, the method would obviously over-value the sample, but the reduction of the estimation to a simple alkalimetric process appeared to him to be an advance on the older methods. He would like to know how the author dealt with substances containing commercial phenols, such as disinfecting powders, soaps, &c., in which the determination of the phenol present was so much more important and difficult than in commercial phenols.

Dr. S. B. Schryver, in reply, said, with regard to the withdrawal of water, he had described in the paper various experiments with mixtures up to 5 per cent. He had made mixtures of pure phenol with various proportions of water, and had determined which reagent gave the best results, and had proved that sodium acetate yielded almost absolutely accurate results, as it withdrew all the water in a day. He admitted the force of Dr. Rideal's objection that one cannot determine the relative quantities of phenol and cresol present in mixtures; but the same objection applied to all other known processes, even if combustion were employed. His own experiments with mixtures of pure phenol and cresol showed that their relative quantities could be determined by this method within about 10 per cent. The principal advantage claimed for the new method was that it was practicable where certain other older methods were not, such as in the estimation of phenols in essential oils.

NOTES ON CACAO BUTTER.

BY DR. J. LEWKOWITSCH.

In the course of the examination of a number of cacao butters submitted to me recently, a few observations were made which are not in agreement with published and accepted statements. I therefore thought it might be worth while to have them placed on record.

There being at the outset a strong suspicion that the submitted cacao butters were adulterated, the first step was to ascertain their physical and chemical constants, and to compare them with those published by previous observers.

The constants given in the table on next page were considered sufficient in number to establish with satisfactory accuracy whether adulteration with foreign vegetable oils and fats had been practised.

Those numbers agree with the constants accepted hitherto, with the exception of the Reichert-Meissl value (the constant for volatile fatty acids), Allen having given the Reichert value of cacao butter as 1·6, which is equal to Reichert-Meissl value of about 3·52.

This rendered it necessary to examine a few genuine cacao butters. The numbers so obtained are collated in the table. It will be seen that Allen's number must be abandoned, cacao butter not differing in its content of volatile fatty acids from the majority of vegetable and animal glycerides. The detection of considerable quantities of cocoanut and palm-nut oils in adulterated cacao butters is therefore easy, and mixtures of genuine cacao butters and cacao butter substitutes in about equal quantities, which would have passed as pure if judged by the Reichert-Meissl value alone, can be easily identified by the combined determination of the saponification, Reichert-Meissl, and iodine values.

It is due to this hitherto accepted, but erroneous Reichert-Meissl value that the statement that cacao butter contains small quantities of formic, acetic, and butyric acids has found its way into text-books.

From the numbers given under the heading "constants," it follows that vegetable oils and fats, such as almond oil, olive oil, hazel-nut oil, sesamé oil, cocoanut oil, and palm-nut oil must be absent; further, that beeswax and paraffin wax could not be present, and, as is shown by the melting point of the fat and the solidifying point of the fatty acids, that considerable quantities of tallow could not have been admixed with the butters.

The numbers given under the heading "acid value," although not negligible in the present case, are not excessive, as comparison with the others show. I shall revert to these numbers further below; it will suffice here to point out that they practically exclude the presence of stearic acid.

Table No. 1.

Physical and Chemical Indices of Cacao Butters.

No.	——	Constants.					Variables.
		Melting Point.	Solidifying Point of Fatty Acids (Titer Test).	Saponification Value.	Reichert-Meissl Value.	Iodine Value.	Acid Value.
		° C.	° C.				
1	Samples submitted for examination.	26·6—28	47·2—49·2	191·8—194·5	0·38—0·94	34·27—36·99	1·82—4·49
2	Cacao butter prepared in the laboratory from nibs.	28·4	..	192·9	0·50	35·65	1·95
3	Genuine cacao butter kept 10 years in a sealed bottle.	27·0	48·0—48·27	192·0	0·20	36·92	4·60
4	Genuine English cacao butter, fresh.	28—33	48·55—49·1	193·5	0·38	35·37	1·65
5	Genuine English cacao butter, another make, fresh.	28	48·85—49·2	193·1	0·33	34·86	1·39
6	Genuine Dutch cacao butter, fresh.	27·2—33	..	192·8	0·83	34·55	1·1

As stated already, considerable quantities of tallow—say exceeding 10 per cent.—were absent, but before the samples could be pronounced genuine, smaller quantities of this adulterant had to be searched for.

As a reliable comparative, though preliminary, test, Björklund's (Chem. Anal. of Oils, &c., 2nd ed., p. 528) ether test may, on the whole, be recommended. I found that cacao butters containing as much as 10 per cent. of tallow will dissolve in 2 parts of ether at 18° C., although requiring a little longer time than genuine butter does. The chief indication, however, to be relied upon is not so much the number of minutes required for crystallisation—as the time will vary with different samples—but the characteristic way in which genuine cacao butter crystallises as compared with adulterated samples. In the former case, distinct crystalline tufts of crystals appear at the bottom and the sides of the containing vessel, whereas five and more per cent. of tallow are recognised by flocks separating from the cooled solution.

The modification of Björklund's test recommended by Filsinger, *viz.*, to dissolve 2 grms. of the sample in 6 c.c. of a mixture of 4 parts of ether and 1 part of alcohol, is the reverse of an improvement. According to Filsinger, the solution of genuine cacao butter should remain clear on cooling to 0° C. Since the pure butters I had to deal with crystallise from the above solution at 9° C., and some even at 12° C., this test is apt to mislead, and must therefore be abandoned. No doubt, samples containing five or more per cent. of tallow crystallise more rapidly than genuine butters, but the characteristic difference in the appearance of the crystals noticed above seems to be lost entirely.

I hoped that more definite information would be obtained by microscopical examination. It is true the difference between the crystals of tallow on the one hand and of cacao butter on the other as obtained, *e.g.*, from the above-mentioned alcohol-ether mixture, is very great indeed, the tallow crystals forming curved tufts somewhat of the shape of an "*f*," the ends of the *f* resembling horse-tails, whereas the cacao butter crystals have the appearance of densely packed clusters of needles radiating from a common centre in all directions. Yet in mixtures of the two fats the influence of tallow, if present to an extent of 5 or even 10 per cent., becomes so indistinct that it would be hazardous to pronounce a definite opinion one way or another. Ether alone as a solvent gave no better results.

A definite answer to the question whether tallow was absent was, however, given by the examination of the unsaponifiable matter under the microscope. Through Bömer's researches (this Journal, 1898, 954) the few apparent exceptions to the general rule that all vegetable fats and oils contain phytosterol, whereas animal fats and oils are characterised by cholesterol, have been happily disposed of. Now, if my samples were pure, their unsaponifiable matter should exhibit the crystalline form of phytosterol only. Indeed, the unsaponifiable matter separated from 500 grms. of fat gave exclusively those forms which have been described already by both Bömer and, later on, by Zetzsche (Pharm. Centr. Halle, 1898, No. 49) as belonging to phytosterol. In the present case, as indeed should be done in every case of a suspected sample, the unsaponifiable matter was repeatedly recrystallised from alcohol, and each crop of crystals examined, the object being to remove the bulk of the phytosterol, if possible, at first, so as to gradually obtain crystals in which cholesterol, if present through admixture with tallow, would commence to exercise its influence. No sign of cholesterol was found, so that there was no doubt about the absence of tallow. Additional proof was obtained by determining the melting point of the fifth crystallisation; the crystals melted at 135° C.

I may add that, contrary to Bömer's statements, I did not obtain the mixed form of crystals from artificial mixtures of cholesterol and phytosterol, but found that each constituent crystallised separately, the two different forms lying side by side in the mother liquor.

There is one more point to consider with regard to cacao butter. In a number of text-books, though mostly antiquated, the note may be found that cacao butter is remarkable in that it does not become rancid, and as this is still being copied by some writers, it may not be out of place to again emphasise the fact, well known to manufacturers and distinctly stated by Dieterich (Chem. Anal. of Oils, Fats, and Waxes, 2nd ed., p. 527), that cacao butter can, and indeed does, turn rancid.

The undoubted fact that specimens of cacao butter have been kept for a number of years without becoming rancid cannot, of course, controvert the above stated truth. The specimen I had kept for 10 years (No. 3 in the table) had not turned rancid, nor had a specimen of linseed oil kept for 13 years (compare this Journal, 1899, 51), nor indeed would any other fat or oil become so, after however long a time, if kept properly, *i.e.*, protected from exposure to air and light.

On looking at table No. 1, we find that practically the only difference between the old cacao butter and the fresh ones is that the acid value has gone up. The same fact strikes one on referring to the sample of linseed oil 13 years old, where the acid value has gone up to 7·2. I have elsewhere (Chem. Anal. of Oils, Fats, and Waxes, 2nd ed., p. 10) laboured to show that acidity is not coterminous with rancidity, and my excuse for repeating this statement must be that not only in common parlance, but also by many chemists, rancidity is identified with acidity. A fat or oil may well be acid without necessarily being rancid. In the present case the majority of the specimens referred to under No. 1 and the specimen No. 3 were decidedly acid, but not rancid.

The confusion of these two terms is due to the fact that *acid* fats and oils are frequently rancid as well, and is accentuated by the absence of chemical tests. Recently several chemists proposed to detect rancidity by showing the presence of aldehydes, but I should prefer to rely on the so-called organoleptic tests, *viz.*, taste and smell, if the question has to be answered whether a fat is rancid or not (see further below).

In order to prove by experiment that cacao butter will go rancid like any other fat, I exposed one of the samples submitted to me, which was still "sweet," and the other genuine cacao butters for a few days (3—4) to the combined action of light (sunshine), air, and moisture, and in this comparatively short time all the samples had become white and decidedly rancid, having acquired a nauseous taste and the repulsive smell of a rancid fat. As a glance at the table No. 2 will show, the acid values had in only one case increased to a very slight extent, and in the other three cases had even decreased. After the lapse of a fortnight the samples were again exposed, there being then bright sunshine, and although taste and smell left no doubt as to their rancidity, the chemical indices, *viz.*, acid value, saponification value, and Reichert-Meissl value, gave no clue as to the enormous change that had been wrought by the exposure. Incidentally I may remark that Schmid's method (this Journal, 1898, 611) of testing for rancidity was applied to specimen No. 1, but the metaphenylenediamine had not become more deeply coloured, whereas silver nitrate and Schiff's reagent gave indications of the presence of reducing substances. In the case of a rancid cocoanut oil the yellowish tint of the metaphenylenediamine had even disappeared, and a colourless liquid was obtained.

TABLE No. 2.

No.	Description.	Not Rancid.				Rancid.				
		Acid Value.	Saponification Value.	Reichert-Meissl Value.	Acetyl Value (Apparent).*	After 3—4 Days' Exposure.	After lapse of a Fortnight again exposed 3—4 Days.			
						Acid Value.	Acid Value.	Saponification Value.	Reichert-Meissl Value.	Acetyl Value.
1	Specimen submitted to examination "sweet."	1·88	192·6	0·72	2·86† 2·71‡	..	1·85	193·1	0·44	5·0† 4·8‡
3	Genuine cacao butter, kept 10 years in a sealed bottle.	4·60	192·0	0·20	..	5·74	6·36	191·4	0·55	10·0† 10·0‡
4	Genuine English cacao butter ...	1·65	193·5	0·38	..	1·40	1·70	193·4	0·55	..
5	Genuine English cacao butter, another make.	1·39	193·1	0·33	..	0·91	..	..	..	4·4† 4·9‡
6	Genuine Dutch cacao butter	1·1	192·8	0·83	..	1·06	1·69	193·0	0·44	5·7† 5·9‡

* Compare Chem. Anal. of Oils, &c., 2nd ed., p. 166. † Distillation method. ‡ Filtration method.

I have added the apparent acetyl values when determined, but I refrain from drawing any conclusion until a more extended series of rancid fats has been examined in this direction.

It has thus again been made evident that cacao butter does turn rancid, and one wonders how the belief in its exceptional position could have been maintained with such pertinacity up till recent years.

The explanation must be found in the fact that cacao butter was largely used in pharmaceutical practice. The pharmaceutical chemist required a fatty substance which would not become rancid easily, and as cacao butter happens to possess the lowest iodine number of all fats which might come within his purview (cocoanut oil and palm-nut oil being naturally excluded), it justified the confidence bestowed upon it; for we know that, speaking broadly, the liability to becoming rancid may be considered as standing in a direct ratio to the iodine value. No doubt the high price of this fat rendered it necessary to treat it more carefully than one would do in the case of, say, tallow, and I have no difficulty in believing that this greatly militated in its favour.

In a paper published last year in the Russian Pharmaceutical Journal, Organow (Chem. Zeit. Rep. 1898, 181) appears to ascribe the keeping properties of cacao butter to theobromine, and he states that butters free from alcohol-soluble substances become rancid more readily than ordinary cacao butter; and, further, that an alcoholic extract of cacao butter added to other fats rendered them less liable to turn rancid than they were before. I have not yet been able to obtain the original paper, but in view of my experiments on genuine cacao butters, obtained from the best makers, I considered it unnecessary to repeat Organow's experiments, which I simply give for what they are worth.

After the above lines were written I obtained a translation of part of Organow's paper; but after its perusal I do not see any reason to alter my opinion.

DISCUSSION.

Mr. OTTO HEHNER said that the author had given them a text which might serve as the basis for the discussion of a portion of his paper, *viz.*, "that everybody knew what tastes and smells badly." Going on that basis, and ignorant of the chemistry of foods, people had been eating cocoa and preparations made from it for a long time, and had come to the conclusion that such preparations were not liable to acquire a bad taste or smell, and kept almost indefinitely. Chocolate creams, for instance, were not as a rule preserved in a scientific manner, yet they kept well in spite of the high percentage of fat contained in them, while most other fatty materials soon deteriorated and became rancid. That by torturing cocoa fat it could be made to undergo change was not astonishing, but the author of the best text-book on the subject of fats and oils would doubtless acknowledge that, in our present state of knowledge, we were not justified in concluding that because two oils had apparently similar compositions, or had the same iodine absorption, they must therefore be equally liable to oxidation. He would remind the author that we did not even know, for instance, why linseed oil dried rapidly, while fish oil was a non-drying substance, although both had practically the same iodine absorption.

The natural instincts which had led mankind, with no knowledge of chemistry, to eat pease pudding with pork, and to combine in their diet nitrogenous and carbonaceous bodies, and from centuries of experience to come to the conclusion that cocoa and cocoa fat had keeping qualities which distinguished them from similar materials, could not be explained away by a few experiments such as the author had laid before them.

Mr. E. GRANT HOOPER wished to know if the author had made any investigations on the refracting power of these cacao butters. With such ready determinations as were available with the aid of the Zeiss butyro-refractometer, it appeared undesirable that these should be wholly neglected for more lengthy operations. His own experience had been that the refraction of cacao butter varied but slightly, and afforded a ready test of the genuineness of the fat under examination. With regard to the stability of cacao butter, he might mention that he had had a sample loosely wrapped in paper for over 10 years, and it had never given any evidence of rancidity in that time.

Mr. A. R. **Ling** said that an enzyme—lipase—was known which hydrolysed certain fats, and he believed that other decompositions of oils had been attributed to enzymic action. That being so, it appeared to him that the tendency of fats to become rancid might be in some way connected with the geometrical arrangement of their molecules, and that the phenomenon might be analogous with that of the fermentability of the sugars.

Dr. F. B. **Power** thought it would be interesting if the author could give some explanation of the cause of rancidity if it was not connected with the liberation of fatty acids, as it was to be assumed that some chemical change took place. In the case of cacao butter its stability was generally attributed to the presence of aromatic substances having a very agreeable odour; and it had long been known that certain balsamic or resinous bodies have a decided influence in the preservation of fats, as in the case of lard, which ordinarily soon became rancid owing to the development of fatty acids. This change could be retarded by impregnating the fat with benzoin, and is usually accomplished by simply suspending the powdered benzoin in the melted fat, and allowing it to stand for some time at a gentle heat.

Dr. J. **Lewkowitsch**, in reply, said, with regard to Mr. Hehner's argument, that an expert in the fat industry, dealing with large quantities of material, got so accustomed to tasting that he was able to tell by that means alone with accuracy what was the condition of the material. For that reason he highly recommended and relied on that practice. That cacao butter did turn rancid, chocolate manufacturers were well aware of, and they therefore treated their products in such a way—by wrapping in tinfoil, &c.—that they would not readily get rancid. The behaviour of butter fat, however, should not be put on a par with cacao butter, but be compared with fats of a similar composition. He quite admitted that he had "tortured" these samples, because he wanted to show the action of light and air (in short, of exposure) in as short as possible a time; hence recourse had to be had to an exaggerated manner of treatment. The reason why cacao butter should not readily turn rancid was because it had one of the lowest iodine values, cocoa-nut and palm-nut oil falling, of course, outside the range of fats to be considered here. Mr. Hehner had tried to weaken that argument by asking him to explain the striking different characteristics of fish oil and linseed oil. He might return the handsome compliment which Mr. Hehner had paid him by inviting him to publish the concluding part of a paper he had given recently, as he (Mr. Hehner), no doubt, would supply the answer to that question. With regard to Mr. Grant Hooper's question, he had not examined this fat by means of the refractometer because it would have given him no indication as to adulteration in the present case. As Mr. Hooper had examined cacao butter that way, he would remember the figures published by Strohl, which showed such wide divergence as to be quite useless for his purpose. In reply to Mr. Ling he might say it had been shown that the enzymes and micro-organisms had nothing to do with the question of rancidity, but this was still considered more or less an open question.

In reply to Dr. Power one might consider the presence of theobromine as favouring the keeping properties of cacao butter, and he had therefore endeavoured to find the proofs for that assertion in Organoff's paper. His main object in reading this paper was to emphasise the fact that cacao butter did not behave differently from other fats of similar composition as regards rancidity.

The **Chairman** looked upon the paper as one deserving of very careful and even respectful consideration, coming as it did from one who was recognised as a high authority on the subject. Communications of this character were always to be welcomed, and if the present paper had had no other result than eliciting the characteristic speech made by Mr. Hehner, he was sure that the author would feel amply repaid.

THE USE OF IRON AS THE ACTIVE ELEMENT IN PRIMARY BATTERIES USED FOR ELECTROTYPING.

BY COLONEL J. WATERHOUSE, I.S.C.

Apropos of Mr. A. A. Beadle's paper published in the Journal for April last, p. 282, the following note of some experience of the use of iron as anode in batteries for electrotyping and duplicating engraved copper plates in the Survey of India Office, Calcutta, may be of interest.

In 1878–79, I was engaged in working out a process of photographic engraving in which an ordinary carbon photograph was developed upon a polished silvered copper plate and then electrotyped. For the latter purpose I used Smee's batteries, but found some difficulty in getting good deposits upon the gelatin, and the more so because the acidity of the depositing solution was injurious to the gelatin surfaces. Shortly afterwards I had the opportunity of visiting the Imperial Military Geographical Institute in Vienna, where I found a very simple system of electrotyping in regular use for the production or duplication of the engraved topographical maps which were prepared by a process of photo-engraving very similar to that which I had been working in Calcutta.

It was on the principle of the Daniell two-fluid cell and consisted of an outer wooden trough suitably lined, containing a solution of sulphate of copper, and an inner trough consisting of a wooden frame upon which paper parchment was tightly strained, so as to form a porous diaphragm. The copper plate to be electrotyped was placed face upwards in the outer trough, within six or eight inches of the porous bottom of the inner and upper trough which contained a weak solution of sulphuric acid and the anode, which was amalgamated zinc for starting and then replaced by iron.

When I came to try this method myself in the course of some further experiments in photographic engraving at the Autotype Works in 1881, I found the paper parchment diaphragm not altogether satisfactory in use, and sought to replace it by some other material, finally fixing on well-tanned leather as most suitable.

The apparatus I afterwards used in Calcutta for electrotyping the photo-engraved plates and also for duplicating large hand-engraved copper plates up to 42 ins. × 28 ins., was on the same principle.

The inner trough was a wooden frame with sides about 6 inches deep. Over the bottom of it a piece of leather was stretched tightly while wet and fastened all round with copper nails. The edges of the leather and the corners of the trough were painted over with electrical cement, so as to prevent leakage, except by permeation through the leather. For the starting trough, with zinc anode, stout kid skin was used, and for smaller sized troughs, with iron anodes, sheep's skin or ordinary leather was used, but for the large sized troughs good thick ordinary leather (cowhide) had to be used. Along the ends of the trough inside there were ledges about half-an-inch thick for the zinc or iron anode plates to rest on.

The outer trough was about seven or eight inches deep and made long enough to permit the plate bearing the relief to be passed in and out below the inner trough, without having to lift up the latter, so that the state of deposition on the cathode plate could be easily examined at any time, or the plate could be taken out and cleaned. The large troughs were lined with lead, well pitched over, but good cementing with electrical cement was found to answer well for small troughs. The solution of sulphate of copper contained in the trough was kept at saturation by crystals of the salt, placed in perforated boxes at the sides of the trough, which were lined with flannel or cotton cloth, to prevent dirt getting into the solution.

The silvered copper plate bearing the gelatin relief was supported on a copper plate coated with electrical cement on both sides, but carrying studs on the upper surface about $\frac{1}{4}$ inch high, the points of which were kept bright, in order to produce electrical contact with the under side of the silvered plate. One side of the supporting plate had a stout upright copper band riveted to it, and the free end of the band was fitted with a connecting screw. For large plates two or three such bands were used.

In this manner the plate bearing the gelatin relief, or the engraved copper plate, was left quite free for removal, while the loose electrical contact at various points of the under surface was found quite sufficient for all purposes.

Before starting a plate, the solution of sulphate of copper was carefully filtered into the outer trough and an amalgamated zinc plate, about the same size as the plate to copied, with a copper band soldered to one side of it and wrapped up in thin cotton cloth, was placed in position in the inner trough with kid-skin bottom. The supporting plate was laid in its place at the bottom of the outer trough, the plate to be deposited upon was laid upon it, and then the upper trough with zinc plate was placed in position immediately above it, and the proper quantity of dilute sulphuric acid, containing one part acid to 60 of water, was poured in to cover the zinc to a depth of half an inch or so. The connection was then completed.

As soon as the cathode was thoroughly well covered with copper, after a few hours' deposition, the plate was changed into the ordinary depositing battery, with a piece of ordinary sheet iron about ¼ in. thick as anode, instead of the zinc plate, the strength of the dilute sulphuric acid being 1 to 40.

While depositing, the cathode plate had to be washed every morning to remove dirt; and if any lumpy nodules or other irregular deposits should have formed on the face of the deposited copper, they had to be removed by filing. The iron plate was also washed and the acid renewed every other day. As a rule the deposition proceeded very evenly and regularly, at the rate of about 2 to 2½ oz. a day per square foot. The whole arrangement was found exceedingly simple and could quite easily be worked by the natives. The use of the zinc plates for starting was only necessary when depositing upon gelatin surfaces—for engraved copper plates the iron anodes were quite sufficient. The E.M.F. of the arrangement was about half a volt, and with large plates the current was about 13 to 14 ampères.

These batteries were found very economical and generally satisfactory, and were still in use for duplicating engraved plates when I left the office two years ago. We were not troubled by deposits of basic iron, but the porous leather diaphragms were rather liable to get deposits of copper upon them, which were troublesome to remove without making holes in the leather. This was probably due to having the diaphragm too close to the cathode, especially in hot weather, when action was brisker. The copper solution kept clear, but generally must have contained a large amount of iron and acid. The quality of the deposited copper was, however, as a rule, good, with a clear ring when struck. Latterly we constantly obtained highly polished sheets of thin copper by electrotyping in this way, for use in photo-typographic processes, for which it was found very suitable and cheaper than the ordinary sheet copper to be obtained in the market.

Batteries of the same kind were also in use in the Military Topographical Institute in Florence many years ago; and the Novello battery, mentioned by Mr. Guttmann, seems to be on the same principle.

THE RECOVERY OF IODINE FROM WASTE PRODUCTS.

BY F. D. CHATTAWAY, M.A., AND K. J. P. ORTON, M.A.

The high price of iodine makes its recovery from waste products a matter of importance even in the laboratory, and still more so in various industries where it is employed. The method ordinarily used, that of passing nitrous fumes into the waste material (Beilstein, Zeitschrift für Chemie, 1870, **13**, VI., 528), is only available when the iodine is present as a soluble iodide, it is not applicable to any oxidised form of iodine.

If insoluble iodides are being worked up, they are commonly first converted into zinc iodide by the action of metallic zinc (Henry, Berichte, **2**, 599), while any organic matter has to be destroyed by fusion with alkali.

The use of nitrous fumes is, moreover, unpleasant, and some of the iodine is very liable to be converted into iodic acid.

We have recently had occasion to recover iodine in large quantities from soluble and insoluble iodides and from iodates, as well as from various organic residues, and for this purpose have employed a method which, on a laboratory scale, works excellently.

We treat the waste material, either dissolved or in a solid state, with a mixture of nitric and hydrochloric acids. All substances containing iodine are decomposed by such treatment, the contained iodine being wholly converted into iodine monochloride.

The application of the method is extremely simple: the material from which iodine is to be recovered is heated on a water bath with aqua regia containing a slight excess of hydrochloric acid, cautiously at first, but finally nearly to boiling, no appreciable loss of iodine taking place. In the case of soluble iodides or iodates, the theoretical quantity only is required; insoluble iodides need slightly more, while, if organic matter is present, a variable and larger excess must be employed.

If waste oxidising agents are available, as, for example, the residue from the manufacture of chromic acid, they may be used in place of the nitric acid, modifications of the method easily suggesting themselves.

The iodine can be obtained from the monochloride in a state of great purity in various ways. The whole may be divided into equal parts, and one decolourised by the cautious addition of sulphur dioxide or a sulphite, all the iodine at once separates on mixing this with the undecomposed moiety; or the solution of the monochloride may be much diluted with water and allowed to stand, when the element separates in splendid long crystals.

Lastly, if very pure iodine be required, the monochloride may be poured into an excess of ammonia, whereby about 95 per cent. of the iodine is converted into nitrogen iodide. This, after washing, may be warmed with an excess of water to about 60° as recommended by Stas (Nouvelles Recherches, 1865, p. 157), when it quietly decomposes, yielding most of its iodine in an absolutely pure state.

Manchester Section.

Meeting held on Friday, April 7th, 1899.

DR. D. WATSON IN THE CHAIR.

THE CONNECTION BETWEEN FLASH POINT AND DANGER IN BURNING MINERAL OILS.

BY WILLIAM THOMSON, F.R.S.E., F.I.C.

(*Abstract.*)

About the end of the year 1895 I commenced to study the nature of burners of paraffin oil lamps which were said to have exploded, and at the instance of the Manchester and Salford Sanitary Association, the Chief Constables of Manchester and Salford instructed the police to give me their aid in this investigation by collecting for me the burners of lamps which had exploded. It was obviously impossible for them to be quite certain in every case that the reservoir had really exploded, but no case was investigated in which fire was caused admittedly by the upsetting or accidental breaking of a lamp.

Commencing from about the end of 1897, samples of the oil which were being used at the time of an alleged explosion were also secured.

Up to the present time (April 1899) 40 burners of lamps which were alleged to have exploded and 15 samples of oil therein have been examined, and the following is a *résumé* of the results obtained :—

31 burners bore the trade mark "The Queen Anne."
1 was of the same type as "The Queen Anne," but not marked.
1 was either "The Queen Anne" or the "Eureka" burner.
3 were marked "Duplex" burner.
2 were marked "Eureka."
2 bore no trade mark, but were of the same type as the "Eureka."

Total.. 40

Of the 15 oils examined by me—

2	had a flash point of	75° F.	2	had a flash point of	85° F.
1	„ „	76° F.	2	„ „	87° F.
1	„ „	78° F.	2	„ „	88° F.
1	„ „	82° F.	2	„ „	89° F.
2	„ „	84° F.			

Roughly speaking, 4 of the 15 oils ($26\frac{1}{2}$ per cent.) were of the American low-flash type, and 11 were of the Russian oil type ($73\frac{1}{2}$ per cent.). Not one was of the Scotch oil type, having a flash point at or over 100° F.; in fact, not one came within about 11° F. of that standard.

I have, like many others, endeavoured to produce under ordinary conditions an explosion in a paraffin oil lamp sufficient to shatter the receptacle, but have always failed. There is, however, in my mind, little doubt that such explosions can be produced, but they depend first on obtaining the exact mixture of the oil vapour and air, and second, upon the nature of the oil vapour. If there be a little too much oil vapour, or a little too much air, or an imperfect admixture of the two, the explosion will not be a serious one. I think we may take it, however, that the theoretically perfect admixture of oil vapour and air sufficient to produce the maximum explosion does not exist in any ordinary oil lamp for one minute during the evening on which it burns once in 10,000 burning lamps, even if a serious explosion could occur under these most favourable conditions. But other conditions besides the theoretically perfect admixture are also required; for instance, the wick tube in which the wick is too small, if reasonably clean, will prevent the passage of a flame down it by reason of the cooling effect on the flame of the comparatively narrow metallic wick tube; and even when the heat-conducting properties of the wick tube are much reduced by a coating of smoke and dirt, the flame will not be likely to penetrate to the receptacle if the air remain still. I have on several occasions unsuccessfully endeavoured to explode the reservoir of a lamp, filled with a theoretically perfect admixture of oxygen and hydrogen, with a burning wick which did not perfectly fit the tube, but which left a clear space down which the flame was to travel. What is further required under such conditions is a sudden blow of air which will carry the flame rapidly down the tube, on the same principle that a rapid current of air or a vortex air ring shot against a miner's safety lamp will carry the flame through the wire gauze and ignite the gas outside. As all these conditions must be fulfilled at the same moment, it is a coincidence which would not occur more than once in 10,000,000 times during which a lamp is burning. In other words, if a man lighted a somewhat dangerous lamp every night for 3,000 years, he would only meet with one serious lamp accident during that time; but as about 20,000,000 lamps are lighted in the United Kingdom every evening, two accidents per day would occur, which, if fatal to one person, would mean the deaths of about 700 persons per annum.

As to the character of the combustible vapour, if we take a good soda-water bottle and fill it with a mixture of one volume of oxygen and two volumes of hydrogen, and then apply a flame, the explosion produced would probably not be sufficient to smash the bottle, although the gases exist in the exact proportions to produce complete combustion. If, however, we mix in the same vessel three volumes of oxygen and one volume of olefiant gas, C_2H_4, proportions calculated to produce complete combustion, and apply a flame to the mouth, the force of the explosion will shatter the soda-water bottle to pieces.

The maximum explosion is, however, probably not obtained by an admixture of the combustible and supporter of combustion in the exact proportions necessary to produce complete combustion. Prof. Harold Dixon, F.R.S., has shown that an explosion of a mixture of oxygen and hydrogen along his tubes was more rapid when the mixture contained a small excess of hydrogen beyond that required for complete combustion; and I have found on several occasions that, on filling a eudiometer tube with an electrolytic mixture of oxygen and hydrogen containing a small excess of hydrogen, the tube remained intact during a number of explosions, each explosion leaving a small excess of hydrogen; but invariably the sixth or seventh explosion shattered the eudiometer tube to pieces. This accords with Dixon's observation that the excess of hydrogen gradually accumulates in the eudiometer till ultimately the violence of the explosion caused thereby shatters the tube. He has also shown that explosive mixtures, such as chlorine and hydrogen, will not explode on the application of a flame if they be perfectly dry, and it is reasonable to assume that water vapour may play some considerable part in the explosive violence of any mixture of oil vapour and air or oxygen.

The chemical composition of air may be taken roughly at four volumes of the inert gas nitrogen and 1 volume of oxygen; to produce an explosive mixture of olefiant gas (C_2H_4) with air would therefore require 1 volume of the former to 15 of the latter, and it is calculated that with the heavier oil vapours about 1 volume of vapour must be mixed with about 50 volumes of air to produce an explosion of maximum violence.

It cannot be doubted that many of the lamp explosions in Manchester and Salford which have come under my notice were real explosions, since the police reports state that someone was blowing out the lamp when the reservoir exploded; or that the lamp was burning quietly when no one was near it, when it suddenly exploded; or that someone left the room in which the lamp was burning, and on returning a few minutes later the lamp was found broken and the room in flames. Assuming that oils of the low-flash American type and higher-flash oils of the Russian type are bought and used in equal quantities, the above observations would prove that, so far as explosions are concerned, the higher-flash oils are more dangerous than the low-flash oils. But I am informed that in Manchester and Salford a larger quantity of low-flash oils are sold than of higher-flash oils. Thus the high-flash Russian oils are probably four times more dangerous than the low-flash American oils, since the conditions of temperature of the room and the lamp are such as to give more often the mixture of oil vapour and air requisite to produce an explosion.

All the serious explosions I have investigated have occured in lamps with glass reservoirs. Here the oil would not get so hot as in metal reservoirs, and an explosive mixture of oil vapour and air (1 volume to 50) would be more readily reached than in metal lamps with the greater proportion of oil vapour. The danger of explosion in lamps having metal reservoirs is infinitely less than in those having glass ones.

If low-flash oils be spilled and a flame applied the fire spreads much more rapidly than with an oil of higher flash point, and thus the upsetting of a lamp containing low flash oil is more dangerous than if it contained oil of higher flash, especially if the temperature of the oil be considerably above that of the air, which is usually the case.

It has been suggested that the Government should take the usual plan of settling such matters by splitting the difference between the contending standards of 73° and 100° F., and fixing it about 85° to 86° F.

From the observations above mentioned I think this would give a standard distinctly worse than the one which exists at present, *viz.*, 73° F. (Abel close test), and taking all the facts into consideration, both of danger from explosions in bad lamps and of danger arising from the upsetting or breaking of the lamps, I think there can be no doubt that the standard fixed by Government for the flash point of petroleum oils should not be lower than 100° F. (Abel close test).

After some discussion the following resolution was proposed by Mr. Harry Grimshaw, seconded by Mr. George E. Davis, and carried unanimously :—

"That this Secton of the Society of Chemical Industry urges the Council to at once represent to the Government the desirability of fixing the flash point of petroleum for illuminating purposes at a minimum of 100° F. (Abel test).

New York Section.

Meeting held on Friday, May 19th, 1899.

MR. T. J. PARKER IN THE CHAIR.

FURTHER NOTES ON THE CYANIDE TREATMENT OF SLIMES.

BY F. W. TRAPHAGEN AND W. M. COBLEIGH.

In the course of the discussion of our previous paper on this subject (this Journal, 1899, 112), Prof. S. F. Peckham asked if the plan therein proposed could be successfully applied to a compact clay which was excessively sticky when emulsified with water, and also contained pebbles of quartz and nodules of barytes; also if it required a pug-mill to produce the emulsion, or whether the tailings readily mixed and became suspended in the water.

In answer to the first question, it may be said that it was to meet almost exactly such a condition that the process was devised. In the tailings yard was a great variety of material, the accumulation of many years of milling. In order to thoroughly test the original plan of agitation and filtration the very slimiest tailings in the yard were selected for treatment. After thorough agitation an attempt was made to filter, with no success whatever, although an excellent vacuum pump was available.

The failure was so complete in this case that it was plainly apparent that even with a better class of material the method could at best be but partially satisfactory. It was then that the settling plan was suggested.

The following experiments made by students of the college will show the relative rate of settling :—

First series by Mr. W. T. Shaw.

Series A.—Took 30 lb. of ore, 8 litres of a 1 per cent. solution of KCN.

Run 1.

No. of Decantations.	Water Added.	Minutes Agitated.	Minutes Settling.	Solution Decanted.	Remarks.
	c.c.				Time :—6 hrs. and 46 minutes. Tailings, 5.40 dols. gold.
1	..	60	40	1,020	
2	1,020	20	50	1,300	
3	1,300	10	70	1,000	
4	1,000	5	70	960	
5	960	5	70	1,040	

All the above solutions were turbid, and had to be filtered.

Run 2.

Used One-half Ounce of Lime.

No. of Decantations.	Water Added.	Minutes Agitated.	Minutes Settling.	Solution Decanted.	Remarks.
	c.c.				Time :—3 hrs. and 41 minutes. Tailings, 3.15 dols. gold.
1	..	60	24	2,040	
2	2,040	20	20	2,000	
3	2,000	10	25	1,980	
4	1,980	5	22	2,060	
5	2,060	5	30	2,000	
	8,080			10,080	

6,000 c.c. were thrown away in tailings, while 8,080 c.c. of water were added. Solutions perfectly clear.

Run 3.

Used One Ounce of Lime.

No. of Decantations.	Water Added.	Minutes Agitated.	Minutes Settling.	Solution Decanted.	Remarks.
	c.c.				Time : 3 hrs. and 31 minutes. Tailings, 2.80 dols. gold.
1	..	60	20	2,100	
2	2,100	20	22	2,000	
3	2,000	10	20	2,200	
4	2,200	5	23	2,150	
5	2,150	5	26	2,000	
	8,150			10,450	

6,600 c.c. of solution left in tailings. All solutions clear.

Run 4.

Used Two Ounces of Lime.

No. of Decantations.	Water Added.	Minutes Agitated.	Minutes Settling.	Solution Decanted.	Remarks.
	c.c.				Time :—3 hrs. and 16 minutes. Tailings, 1.94 dols. gold.
1	..	60	20	2,800	
2	2,800	20	18	2,600	
3	2,600	10	18	2,500	
4	2,500	5	18	2,460	
5	2,460	5	22	2,090	
	10,360			12,450	

5,910 c.c. of solution left in tailings. All solutions clear.

Run 5.

Used Three Ounces of Lime.

No. of Decantations.	Water Added.	Minutes Agitated.	Minutes Settling.	Solution Decanted.	Remarks.
	c.c.				Time :—3 hrs. and 45 minutes. Tailings, 2.40 dols. gold.
1	..	60	20	2,950	
2	2,950	20	20	2,500	
3	2,500	10	24	2,380	
4	2,380	5	30	2,000	
5	2,000	5	35	2,000	
	9,830			11,830	

6,000 c.c. left in tailings. All solutions clear.

Mr. T. O. Caldwell experimented with a very sticky plastic clay. The sample was finely ground and passed through a sieve with 100 holes to the linear inch. In each experiment 100 grms. of ore was placed in a 1,000-c.c. measuring cylinder, water added nearly to the 1,000 c.c. mark, cyanide in solution to bring strength of whole to desired point, and then water to the mark. When lime was used it was added as milk of lime. The cylinders were thoroughly agitated by shaking and then allowed to stand, with the following results :—

Experiment No. 1.—No lime was used. At end of five minutes there was some indication of the beginning of settling in the slightly decreasing opacity of the mixture at the top of the cylinder, but it was 23 minutes before there was an appreciable deposit at the bottom. The solution after many hours still remained turbid, and would have remained so after passing any ordinary filter. It takes days to completely settle such a mixture.

Experiment No. 2.—1 grm. of lime added, equal to 1 per cent. of ore. At the end of five minutes the great mass of ore had settled below the 90 c.c. mark, zero being at the bottom, the 910 c.c. of solution being "bright" and perfectly free from finely divided suspended matter, the solid particles present being collected in "flocks," and the whole solution giving evidence of the possibility of perfectly easy filtration.

With larger quantities of lime the time of settling seemed to be hastened, but in this series the quantities were no higher than 2 per cent. A smaller amount of lime would undoubtedly give satisfactory results.

Now as to the treatment to secure flocculation. The material to be treated was usually very fine; in fact, it was this extreme fineness that was responsible for the change of plan of operations. The tailings were dumped into the agitator until the requisite amount, determined by the number of cars, was obtained.

The agitators consisted of large wooden vats, with bars of iron, having a plow-like termination at bottom, working through the charge so as to stir up every portion of the mass. The bars were suspended from a cross-piece above, and by suitable mechanism could be easily rotated, raised, or lowered. As soon as the ore was charged the lime, which had just previously been slaked, was added as a thick paste, the solution turned in, and the agitation begun as soon as the charge was thoroughly covered; the plows very rapidly reached the bottom, and the mixture was kept completely suspended as long as motion continued. The tailings, after a short treatment, seemed to have changed completely in character, and after settling could very easily be penetrated and stirred again.

Certainly these experiments show the possibilities of a similar course of procedure in many operations of industrial chemistry.

There is evidence that lime in many cases aids in gold extraction. It is also to be noted that prolonged agitation decreased the percentage of extraction. Under the conditions prevailing it was noticed that the amount of gold in solution rapidly increased up to a certain point and then slowly decreased. The amount of cyanide used in this method is undoubtedly higher than in percolation, both because of the agitation and also on account of the very large volume of solutions necessary.

Mr. Ellis has courteously drawn attention to some work which he has done along these same lines which clearly antedates the work carried on here. As Mr. Ellis first published an account of his work in 1898 it is plainly evident that the work done in Montana in 1896 was also original work. The description of this treatment in the article mentioned was given such a relatively unimportant position and amount of space, than it can easily be seen how it was overlooked in the search for previous accounts of similar methods to the one described. However, if there is any credit due for the first application of this well-known principle to a new purpose, and there certainly should be, it ought to be given to Mr. Ellis.

The following is the communication from Mr. Charles J. Ellis, Technical Manager of the Cassel Gold Extracting Co., Ltd., of Glasgow, to which the authors refer above :—

"The paper read by Messrs. F. W. Traphagen and W. M. Cobleigh at the meeting of this Section held on January 20th, 1899, entitled : 'A New Departure in Cyanide Treatment' is an interesting one, giving, as it does, a more or less detailed statement of the treatment of certain gold bearing slimes by the agitation, settling, and decantation method of applying the cyanide process, with the use of lime to aid the settling. The writer feels bound however, in justice to himself, as well as to 'The Cassel Gold Extracting Co., Ltd.,' and 'The Gold and Silver Extraction Co. of America, Ltd.,' as proprietors of the MacArthur-Forest process of gold extraction, to take exception to the title of the paper which claims novelty for the method described.

"Just six years ago, *viz.*, in the spring of 1893, the writer, having occasion to treat some 30 tons of gold-bearing slimes in the Glasgow Works of the Cassel Gold Extracting Co., Ltd., and finding the same practically unworkable within a reasonable time by the percolation method of applying the cyanide process, arrived at the same method which has been so recently described by the authors, viz., agitation of the slimes with cyanide solution with or without addition of lime, settling and decanting the supernatant liquor, followed by washing the sludge in a similar way. Practically, this same method has been in extensive use since early in 1895 in South Africa and elsewhere, certain modifications in details having been introduced from time to time to meet local or special requirements. The writer has referred to the above, and made similar statements, in his paper entitled 'Notes on the Testing of Gold Ores, &c., in relation to their treatment by the Cyanide Process," which is published in the Journal of this Society for February 1898. (See No. 2, Vol. XVII. (Feb. 1898), page 130.)

"The beneficial effect of lime as an aid to the settling of slimy matter from suspension in water or other liquids, in a general sense, has been known for many years. In the treatment of certain slimes it may be found almost essential to employ a little lime (or certain other materials) for the purpose stated, but this is not by any means universally the case; and unless this necessity and the advantages to be gained by its use are very apparent it is often advisable to avoid employing it, or in any case to use it sparingly and with due consideration of the effect which any considerable excess of it may have on the efficiency or character of the stock of working cyanide solution."

DOUBLE SALTS OF NICOTINE HYDROCHLORIDE AND CADMIUM CHLORIDE.

BY C. GLASER.

From pure nicotine, obtained by analyses of tobaccos, it was undertaken as a matter of study to prepare the known double compounds of the base as hydrochloride, with the chlorides of zinc, platinum, and cadmium. The first two salts presented nothing unusual, and their analyses agreed well with the formulæ of $C_{10}H_{14}N_2(HCl)_2$, $ZnCl_2$, and $C_{10}H_{14}N_2(HCl)_2PtCl_4$. They were crystallised from alcohol in the usual way.

When it was attempted to prepare the corresponding cadmium compound, the analysis yielded figures which did not at all correspond with theory :—

1.

Found.		Calculated for $C_{10}H_{14}N_2(HCl)_2.CdCl_2$.
	Per Cent.	Per Cent.
N = 4·377 = $C_{10}H_{14}N_2$	25·32	38·82
Cd	41·69	26·74
Cl	32·56	34·44

It was noticed that the crystals presented no uniform appearance. Another portion of a product, crystallised in flakes and scales, showed on analysis :—

2.

		Per Cent.
N =	5·60 = $C_{10}H_{14}N_2$	32·40
$CdSO_4$ =	59·65 = Cd	32·04

It was, therefore, evident that these were mixtures of salts.

The attempt was now made to separate the bodies by fractional crystallisation from weak, hot alcohol, with the following results :—

3.

First Fraction.	Calculated for $C_{10}H_{14}N_2(HCl)_2CdCl_2$.
N = 6·44 = $C_{10}H_{14}N_2$ 37·26	(N = 6·71) 38·82

4. Second fraction, obtained by evaporation of the mother-liquor from the first fraction, dissolving in a little hot water and adding alcohol.

		Per Cent.
N =	4·41 = $C_{10}H_{14}N_2$	25·51

This body separated in hard kidney-shaped forms, without visible crystalline structure.

The final residue from this, obtained by evaporating the second mother-liquor, showed :—

N =	7·19 = $C_{10}H_{14}N_2$	41·60

This simply shows that plenty of nicotine hydrochloride was present in the crystallising solutions.

The salt first obtained (1) and the second fraction of crystallisation (4) were mixed together and repeatedly recrystallised from alcohol.

It all had now the kidney-shaped appearance and was white. Analysis showed the following results :—

0·2000 grms. gave N .... = 0·00833
0·2000 „ „ AgCl......... = 0·2784
0·2000 „ „ $CdSO_4$......... = 0·1473

Found.		Calculated for $3C_{10}H_{14}N_2(HCl)_2, 7CdCl_2$.
N =	4·165	4·24
$C_{10}H_{14}N_2$ =	24·10	24·54
Cl =	34·38	35·75
Cd =	39·57	39·41

The quantity of material on hand was not sufficiently large for a closer examination. A larger quantity of nicotine was therefore prepared from tobacco by freeing the base by sodium hydroxide and extracting with water. The solution was distilled in a current of steam, the distillate saturated with sodium chloride, extracted with ether, which was carefully washed and evaporated at a low temperature on a water-bath. The oily residue was taken up in a little water, neutralised by hydrochloric acid, evaporated, and dissolved in alcohol.

From this solution the cadmium salts were prepared. It was soon observed that when the solution of nicotine hydrochloride was added to an alcoholic solution of cadmium chloride, the latter staying in strong excess, the tendency was toward forming the kidney-shaped compound, almost to the exclusion of the crystallised salt. When cadmium hydrochloride was added to an excess of nicotine hydrochloride, a salt crystallised in radiant clusters of fine needles and thin plates, particularly when some water was added to the alcoholic solution. When no particular attention was paid to the ratios of the separate solutions of nicotine and cadmium, it was repeatedly observed that upon mixing them and heating until a clear solution was obtained (sometimes under addition of a few drops of water), upon cooling kidney-shaped forms would separate out first, which could be removed by filtration. Afterwards only crystals would appear. After accumulation of sufficient quantities of the two compounds and purification by repeated crystallisations from alcohol, the following results were obtained by analysis :—

(*a*) The kidney-shaped compound—

0·2003 grms. gave N..................... = 0·00823
0·1996 grms. gave $CaSO_4$................. = 0·1466
0·1001 grms. gave AgCl.................. = 0·1443

Found.		Calculated for $3C_{10}H_{14}N_2(HCl)_2, 7CdCl_2$.	
N = 4·11 = $C_{10}H_{14}N_2$	23·78	(N = 4·24)	24·54
Cd	39·47		39·41
Cl	35·70		35·75

(*b*.) The crystallised salt. If crystallisation from stronger alcohol was attempted, there was always a tendency to decomposition by the separation of some kidney-shaped forms, while from weak alcohol (about 50 per cent.) only crystals were obtained.

0·2000 grms. gave N .... = 0·10612
0·1000 „ „ $C_{10}H_{14}N_2(HCl)_2PtCl_4$...... = 0·1056
and Pt .... = 0·0378
0·1000 „ Pt .... = 0·0379
0·2000 „ $CdSO_4$ .... = 0·1173
0·1000 „ AgCl .... = 0·1363
0·2000 „ H_2O dried at 100° C................ = 0·0066

Found.		Calculated for $2C_{10}H_{14}N_2(HCl)_2.3CdCl_2, 2H_2O$.
N by combustion 5·31 = $C_{10}H_{14}N_2$ ..	30·72	30·78
Calculated from $C_{10}H_{14}N_2(HCl)_2PtCl_4$	30·72	..
Calculated from Pt..	31·59	..
Cd	31·52	31·78
Cl	33·72	33·64
H_2O	3·30	3·42

All attempts to arrive at a salt corresponding to the formula $C_{10}H_{14}N_2(HCl)_2CdCl_2$ have so far failed, although one of the early preliminary experiments (viz. 3) points to existence. The formation of the two salts obtained, however, furnishes another proof of Remsen's law.

The nitrogen tests were made by soda-lime combustion and titration, except when otherwise stated. An attempt to use Kjeldahl's method gave unsatisfactory results; in as much as only about 68 per cent. of the nitrogen present was converted into ammonia.

In testing the double salt with zinc chloride, before a final purification, the following results were obtained : —

By Soda Lime Combustion.	By Kjeldahl's.
N = 7·084 = $C_{10}H_{14}N_2$, .. 40·99	N = 4·844 = $C_{10}H_{14}N_2$... 28·02

This observation, being in agreement with similar observations made upon bodies belonging to the pyridine- and quinoline-groups, furnishes an additional proof in favour of the theory that nicotine contains a pyridine ring.

Nottingham Section.

Meeting held at Nottingham on Wednesday, May 31st, 1899.

MR. JAMES O'SULLIVAN IN THE CHAIR.

SUGAR AS AN AGENT IN NITROGEN FIXATION AND AN AID TO THE GROWTH OF PLANTS.

BY JOHN GOLDING, F.I.C.

I HAD not intended to publish the results of my work on this subject until I had confirmed and enlarged them by this year's work; but in the meantime so much work has been published on the Continent that I feel emboldened to add my results as they stand to the evidence already before you from other sources.

The great chemical principle which underlies the fixation of nitrogen and which is insisted on by M. Duclaux in his "Critical Review" (see Ann. Inst. Past. 1894, p. 728), and by M. Winogradsky (see Archives des Sciences Biologiques, III., No. 4), is that energy is necessary for the combination of gaseous nitrogen resulting in the formation of organic nitrogenous substances.

Thus in Winogradsky's own experiments in which a medium devoid of combined nitrogen was used, the required energy was obtained from the destruction of sugar, nitrogen being fixed in proportion to the sugar destroyed. His *Clostridium Pasteurianum* was after all only able to grow and fix nitrogen under certain conditions, which conditions could not be fulfilled in Nature without the co-operation of other micro-organisms, namely, organisms to abstract the oxygen from the air and to supply a suitable carbohydrate to give the energy necessary for fixation.

Thus all these organisms must be dependent directly or indirectly on some other organisms, unless they themselves can assimilate carbohydrates from the air, to do which they would have to grow in direct sunlight.

K. Puriewitsch following up Berthelot's researches found fixation of nitrogen to take place in a slight degree by

Aspergillus Niger and *Penicillium Glaucum*, and I have also found assimilation to take place in mixed growths consisting chiefly of *Penicillium Glaucum*, providing sugar is present in the medium.

In all these cases much sugar is decomposed for the fixation of very little nitrogen.

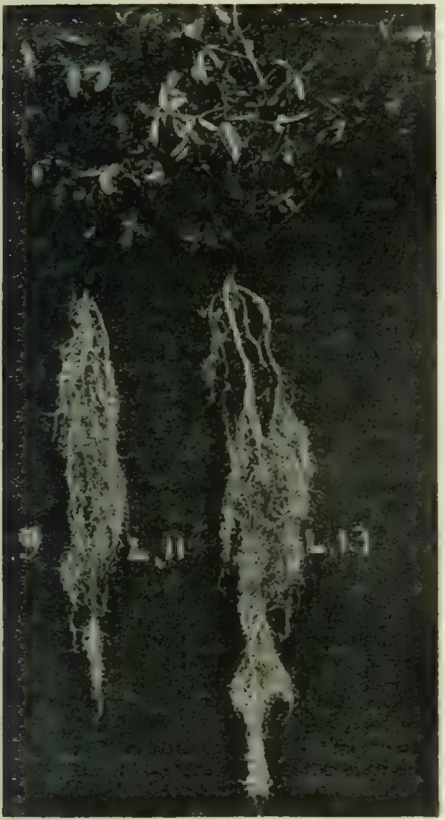
Mazé (Ann. Inst. Past., Jan. 1897) obtained fixation of nitrogen by the micro-organisms from leguminous root nodules grown on a nutritive material prepared from an infusion of haricot beans, to which 2 per cent. of cane sugar had been added.

Finally, although Gautier, Drouin, and P. Kossowitsch have not obtained fixation by Algæ alone (*i.e.*, in pure cultivations), Hellriegel and Th. Schloesing, junr., with Em. Laurent, have proved assimilation of nitrogen to take place in mixed cultures of algæ and bacteria.

Future work must show how great a part this joint carbon and nitrogen assimilation plays in the formation of soils.

Work up to the present time would therefore seem to show that in all cases of assimilation of free nitrogen, the organism is dependent on some other organism for the formation of carbohydrates from which the necessary energy can be obtained.

Lucerne Plants.*



No Sugar. 10 grms. Sugar.

The most certain and rapid way in which nitrogen is at present known to be fixed is by the agency of the micro-organisms in the root nodules of leguminous plants, and even in this case, though much work has been done on the subject, it is not known for certain what part the plant plays.

Mazé's experiments point to the supply of sugar as being the chief, if not the only function of the plant in this respect.

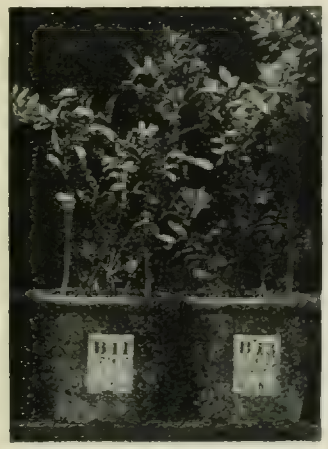
It is to investigate this subject that the following experiments have been undertaken, namely, pot experiments designed to find out if, as sugar supplies the energy necessary for the bacteroids of the root nodules to assimilate nitrogen, an application of sugar would assist this assimilation.

For these experiments pure quartz sand was well washed with tap water, dried in the sun, burned over a bright fire on iron plates, and when red hot poured into water, which was thus raised to the boiling point. The sand was then again well washed with tap water which contained none of the bacteria forming nodules on leguminous plants.

Ordinary flower-pots which had been cleaned and boiled were then filled with the washed sand, pieces of broken pot and fine well washed and sterilised shingle having been placed in the bottom. The filled pots were then boiled for two or three hours in a copper, and on being taken out were placed in sterilised pans and covered with sterilised filter paper.

The seeds were weighed and counted for each pot and were rinsed with mercuric chloride (1 per 1,000) before sowing.

Bean Plants.*



No Sugar. 10 grms. Sugar.

The sowing was performed with sterilised forceps, the filter paper covers only being removed for the shortest possible time.

The manure added consisted of:—20 c.c. of a normal solution of KCl; 10 c.c. of a normal solution of $MgSO_4 7H_2O$; 10 c.c. of a normal solution of $CaCl_2$; 50 c.c. of a $\frac{1}{4}$ normal solution of $Na_2HPO_4 12H_2O$: this application was twice repeated during the course of the experiments.

Pots of Lucerne.*

No Sugar. 10 grms. Sugar.

---

* *Note.*—All these plants are grown in pure sand with a manure, complete with the exception of nitrogen, and inoculated with a crushed nodule from a similar plant.

Thus far all the pots were treated alike. The plants selected for the experiment were bean, clover, lucerne, and sainfoin. Four pots were taken for each crop.

All were fertilised with an equal quantity of water containing part of a crushed nodule from a healthy plant of the same kind as that under experiment. The first and second pots were left for control, the third received 10 grms., and the fourth 5 grms. of pure cane sugar in solution.

The photographs show the results obtained with beans and lucerne.

The weight in grms. of green lucerne plants per pot was :—

	Grms.
(1) With no sugar :—	
Stem and leaves	25·0
Roots	16·3
(2) With 10 grms. of sugar :–	
Stem and leaves	38·1
Roots	21·6

The weight in grms. of fresh bean plants from duplicate pots to those shown in the photograph, with the exception that 5 grms. of sugar was added instead of 10 grms., was :—

	Grms.
(1) With no sugar :—	
Pods	17·15
Plants (stems, leaves, and roots)	36·38
(2) With 5 grms. sugar :—	
Pods	19·7
Plants (stems, leaves, and roots)	42·4

There was not much apparent difference in the crop from those pots which received 5 grms. of sugar and those which received 10 grms. The clover showed a similar result. With the sainfoin, however, no assimilation of nitrogen took place, all the plants remaining stunted, very peculiar nodulated appearances being formed on the roots. These nodulated appearances had not the characteristic pink interior of healthy nodules, nor did they show any bacteroid forms when examined under a high power.

Sugar then in these pots of sand to which no nitrogenous manure had been added produced a marked increase in the growth of certain suitably inoculated leguminous plants with healthy nodules on their roots.

Whether the sugar would act in a similar way on uninoculated plants, and on plants of different orders in the absence and in the presence of combined nitrogen forms the subject of my experiments at the present time.

Since the above experiments were conducted, Jules Laurent has published (Comptes Rend. 1898, 127, 786—787) work showing that seedling plants, such as maize, can grow, increase in weight, and form starch in the absence of carbonic anhydride, and in sterile solutions at the expense of glucose or other carbohydrates supplied to their roots.

Also Mazé (Comptes Rend. 1899, 128, 185—187), working with sterile water cultures, shows that vetches can grow in the dark at the expense of glucose supplied to their roots.

Raoul Bouilhac (Ann. Agron. 1898, **24**, 561—602) has demonstrated that Nostoc in the presence of soil bacteria fixes nitrogen in the absence of organic matter, but the yield is increased fourfold when a dilute solution of glucose is supplied, under which circumstances it can even grow in the dark and form chlorophyll.

These results are not unlikely to become important from a practical point of view, for although sugar and other carbohydrates would, by reason of their expense, probably be beyond the reach of the agriculturist, yet at the same time the growing demand for fruit, vegetables, and flowers out of season would make *any substances* which enable plants under glass to grow to perfection with a minimum of sunlight, invaluable to the nurseryman and market gardener.

Yorkshire Section.

On June 17th the President visited Leeds, when he was entertained at a garden party given by Mr. E. A. Brotherton in the grounds of his residence, Arthington Hall. About 150 ladies and gentlemen belonging to the Section and the Yorkshire College availed themselves of the invitation. The weather was delightful and the grounds were seen to the best advantage.

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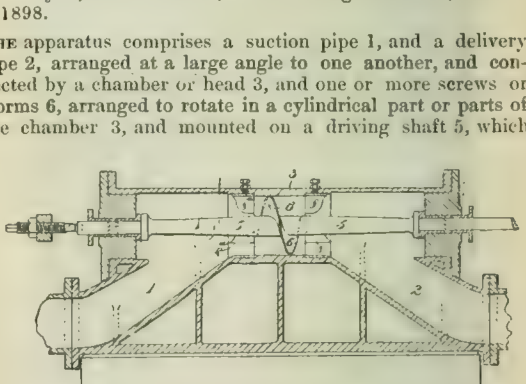
PATENTS.

Raising and Forcing Liquids, Impts. in Apparatus for. J. Gjers, Bournemouth, Hants. Eng. Pat. 239, Jan. 4, 1898.

The apparatus comprises a suction pipe 1, and a delivery pipe 2, arranged at a large angle to one another, and connected by a chamber or head 3, and one or more screws or worms 6, arranged to rotate in a cylindrical part or parts of the chamber 3, and mounted on a driving shaft 5, which is rapidly rotated, so that the liquid is drawn through the pipe 1, and discharged through the pipe 2 to any desired level. Ribs or vanes 8, 8*a*, are fixed to the chamber 3, to prevent a rotary motion being imparted to the liquid.



—R. A.

Filter Presses and Similar Filtering Apparatus, Impts. in. D. Black, Shettleston, Lanark, and J. McL. Wright, Glasgow. Eng. Pat. 964, Jan. 13, 1898.

A number of filtering cylinders, each having an external and an internal filter cloth, through which the liquid passes into the annular space between the cloths, are mounted within a steam-jacketed casing, within which is also mounted a set of revolving brushes or scrapers, arranged to bear, with adjustable pressure, on the surface of the filter cloths. In one form of filtering cylinder, the frame is built up of a series of horizontal rings, strung on vertical tie-rods, and spaced apart by washers, the whole being bound together by channel rings at the ends. The filter cloths on the outer and inner peripheries of this frame are secured between clamping rings and the channel rings. Several modifications are described.—R. A.

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* Any of these specifications may be obtained by post by remitting 8*d*.—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

Clearing Liquids from Solid Matters Suspended in them, Impts. in Apparatus for. The Anglo-Continental Gold Syndicate, Ltd., London. From W. Rothe, Güsten, Anhalt, Germany. Eng. Pat. 13,133, June 11, 1898.

The liquid is drawn into an upright pipe by an air-pump or ejector, which, at the same time, frees it from such air as may render the solid particles buoyant. From the upper end of this pipe the liquid descends through a branch pipe, provided with a distributor, into a settling tank, where the solid matters descend and pass away with some of the liquid, while the purified liquid passes away through an overflow at the top of the tank.—R. A.

Filtering Apparatus, Impts. in. L. H. Bristowe and Co., Ltd., London, and W. R. Renshaw, Phœnix Engineering Works, Stoke-on-Trent. Eng. Pat. 14,400, June 29, 1898.

In filtering apparatus, in which the filtering medium is cleansed by a series of arms radiating from a hub, and "vertically reciprocated" within the medium, a pawl and ratchet mechanism is provided, whereby a step-by-step rotary movement is imparted to the arms, so that they descend through a different portion of the medium each time they are depressed. The arms may be hollow and perforated, to enable the cleansing liquid to be distributed through them.—R. A.

Filtering and Straining Apparatus [Paper Pulp, &c.], Impts. in. A. Bergström, Bosjön, Finshyttan, Sweden. Eng. Pat. 6822, March 29, 1899.

The filtering or straining cylinder 1 is open at the ends, and is provided with circular guides 2, whereby it is supported on the roller-bearings 3 in the tank 5 (Figs. 1 and 2), a rotary motion being imparted to the cylinder by means of the rollers 3 on the power-driven shaft 4. The liquid carrying the fibres is supplied through the inlet 14 (Fig. 2), and passes under the curved plate 15 in the tank (Figs. 1 and 2). The surface liquid bearing the bulk of the fibres passes over the edge of the plate 15 and through the cylinder into the quadrant-shaped receiver 11, from which it flows, over the inclined plate 21, into the trough 6 (Fig. 3). The liquid is withdrawn from this trough by a pump, and returned through the pipes 12, 13, &c. to the inlet 14. The deeper part of the liquid in the tank 5 enters the cylinder through the layer of fibres deposited thereon opposite the receiver 11, and is completely filtered, the waste water passing away through the ends of the cylinder. The trough 6 and receiver 11 are adjustable within the tank.
—R. A.

Fig. 1

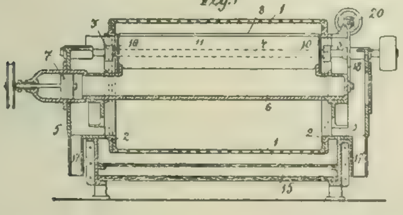


Fig. 2.

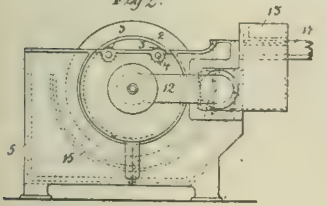
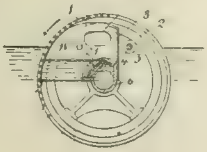


Fig. 3.



Carbonating Liquids, Impts. in Apparatus for. O. W. Ackerman, New York, U.S.A. Eng. Pat. 10,038, May 2, 1898.

See under VII., *page* 582.

Conditioning or Drying Grain, Berries, Sugar, Seeds, Crystals, and Granular or Pulverulent Material generally; Impts. in or relating to Apparatus for. C. Mallinson, 34, Great Mersey Street, Liverpool. Eng. Pat. 10,892, May 12, 1898.

The apparatus comprises "a rotary upright cylinder perforated with air holes, a fixed casing, provided with ventilators, surrounding the cylinder concentrically, so as to leave a space between," and "a continuous worm, or spiral blade," &c., fixed to the exterior of the cylinder, "for slowly elevating" the material to be treated in the space between the cylinder and the casing, "in combination with a fan or other means for causing a current of air to pass through the ascending stream" of material. The interior of the cylinder may be divided into compartments, to admit of hot or cold air, or a mixture of these, being supplied, this arrangement enabling the temperature of the air to be regulated at any part of the travel of the material. The "casing" already mentioned, is connected with ventilators, and communicates with an exhaust trunk, the ventilators being so arranged as to prevent the escape of the material under treatment.—R. A.

Incrustation in Steam Boilers, An Improved Composition for Preventing. Lewis Lewis, Pontywain, near Newport, Mon. Eng. Pat. 10,759, May 11, 1898.

The invention consists of adding to a boiler a composition consisting of cider apple "muss," oak bark, and mountain block peat ash, ground or pulped. The mixture may be made as follows :—1 cwt. oak-bark pieces, 1 cwt. peat ash, mixed together in a tank, to which are added 60 gallons pure spring water. This forms a strong lye, which is then mixed with the muss pulp in equal parts, left to ferment and blend for a few days. The composition so produced may be mixed in a tank and injected into the boiler when required.
—J. G. P.

Pumps for Liquid or Gaseous Bodies and for Various Uses, Impts. in. J. N. Hochgesand, Quai Jemmapes, Paris. Eng. Pat. 26,688, Dec. 17, 1898.

The pump has only one valve, which is placed in the delivery passage, the pump cylinder being mounted on the piston, so that it is moved with the latter, by the friction of the packing, between an adjustable stop and a fixed seat. On the upward movement of the piston, the cylinder is first raised from its seat, to establish communication between its interior and the exterior source of liquid supply, after which the cylinder is stopped and the piston continues to ascend, to draw the liquid into the cylinder. On the down stroke of the piston, the cylinder is first returned to its seat, to cut off communication with the exterior, and then the further movement of the piston forces the liquid through a spring-controlled valve into the delivery passage. The pump is stated to be applicable for feeding boilers, or oil or spirit motors, for distributing oil for the lubrication of machinery, or, as a pneumatic pump, for inflating pneumatic tyres, &c., several modifications suitable for particular purposes being described.—R. A.

Saturators for Ammonium Sulphate Dye Vats, Tanks, Baths, and similar Receptacles for Acids; Impts. in or relating to. F. H. Rowlett, Leicester. Eng. Pat. 5631, March 15, 1899.

The saturator, constructed in sections, having the internal plate of lead and the external plate of iron, consists of a series of pairs of such plates, having their marginal edges turned up all round, and connected by screw bolts, with the interstices between each pair of plates filled in with lead. The structure admits of any individual plate being removed for repairs; or it may be enlarged or reduced in size as required.—E. S.

II.—FUEL, GAS, AND LIGHT.

Coal, Spontaneous Combustion of, and its Prevention. Chem. Zeit. Repert. 1899, **23**, [8], 72. (From Oesterr. Zeits. Berg. und Hüttenw. 1899, **47**, 78.)

The United States Admiralty has made experiments and gives valuable directions for preventing the spontaneous combustion of coal. Anthracite is excluded from the inquiry. Only bituminous coals are liable to catch fire. The ignition of coals may be induced by condensation and absorption of the oxygen of the air by the coal, whereby the temperature is raised so high that chemical combination between the hydrogen and oxygen can take place. This easily happens if the coal be very pure and brittle, if the outside temperature be also high, and the necessary ventilation be wanting. Another cause of ignition is the action of moisture on the sulphur of many pyritous coals, not so much from the heat of the chemical reaction as from the circumstance that the coal is split and broken up, and so fitted for the absorption of oxygen. The arrangements for preventing ignition on board ship cannot be discussed here. On land it is mostly pyritous coal that fires. Care must be taken that the coals are stored on iron floors and covered, the height of the heap not exceeding 2 to 2½ metres, and steam pipes and flues being at least 6 metres away. For sea voyages the coal should not be laden earlier than one month after it has been mined.—L. J. de W.

Breeze, The Disposal of, on Gasworks. E. Froitzheim. J. für Gasbeleucht. 1899, **42**, [12], 193—196.

Breeze is formed both in picking up ordinary gasworks coke with forks, and in screening coke which has been broken by a machine for household use. Attempts to form briquettes by adding waste material from cellulose works to the breeze, and compressing and drying, proved a failure, because the briquettes disintegrated in the fire, and would not burn without the addition of a large proportion of better fuel. Breeze may be burnt in a furnace with forced draught, such as the Wiedenbrück and Wilm's furnace, which has lately been used for heating tubular boilers of the Dürr type at the Cologne gasworks. The grate consists of hollow bars, to the interior of which air under pressure is forced by a steam injector through a chamber which communicates with all the bars. The air passes along a passage near the upper surface of each bar, and is thus warmed; it then issues from holes, inclined upwards, in a lower passage, and is thus spread uniformly over the grate area. The air keeps the bars cool. In one trial, extending over 24 hours, with a boiler having 200·45 sq. m. heating surface, and a grate area of 4·05 sq. m., 5·4 kilos. of water were evaporated per kilo. of breeze burnt. The breeze contained 20·34 per cent. of ash, and 10·96 per cent. of water. About 10 per cent. of the steam was required for the injector. A blast of dry air from a fan had been found to produce cakes of clinker, which stopped the passage of air to the fuel, and the steam injector was therefore adopted.—J. A. B.

Ammonia in a Gasworks, Increasing the Quantity of. Brunet. Proc. Soc. Techn. de l'Ind. du Gaz en France, 1898, 102.

In order to avoid the loss of ammonia which usually takes place in separating the ammoniacal liquor, which is held in suspension by the tar, when the latter is removed from the tanks, the author recommends the following method, depending on the solubility of ammonia gas in water. The method consists in constantly maintaining a layer of water, at least 3 ft. deep, on the surface of the tar in the tanks. By this means the ammoniacal gases are aspirated from the layer of tar next to the water, and each time there is a movement in the mass of tar, the pockets of liquor, large or small, tend to rise towards the surface, where the ammonia they contain becomes dissolved in the water above. The water should be changed so soon as it has a density of 1·5°—2° B. The author, who has used the plan for two years, estimates that the quantity of water put into the tanks amounts to 132,129 galls. per annum, and the yield of ammonia has been successively increased from 4·10 to 4·36 and 4·83 lb. per ton of coal carbonised, without the help of any special apparatus for collecting the ammonia, the gas being only washed in two ordinary coke scrubbers, one watered with weak ammoniacal liquor and the other with clean water.—A. S.

Acetylene, Purification of, by means of Acidified Solution of Chromic Acid. J. für Gasbeleucht. 1899, **42**, [12], 198—200.

Doubts have been expressed on the efficiency of Dr. Ullmann's process for the purification of acetylene by means of an acidified solution of chromic acid. The inventor brings forward the results of trials made by Dr. Wachs, of Carlsruhe, as evidence in favour of the process. Two glass towers, 40 cm. in height, were packed with broken pumice saturated with a solution of crystallised chromic acid in twice its weight of 50 per cent. acetic acid, and the solution also stood 2 cm. above the inlets to the towers. Acetylene containing 0·5066 grm. of phosphorus per cubic metre was passed through these towers, and then through a smaller tower packed with lime and sawdust, which retained any acetic acid sprayed over from the large towers. The gas thus purified was found to be free from phosphorus, and to have only a faint garlic-like odour, when the rate of passage was 29 litres per hour; but at the rate of 119 litres per hour, which was considerably greater than the prescribed rate for the towers used, a small amount of phosphorus was detected in the issuing gas. The illuminating power of the gas was observed before and after purification, and was found to be virtually the same. 5·5 grms. of chromic acid were found to purify 1 cb. m. of acetylene, and the cost of purification by this method was thus shown to be about 0·3 per cent. of the cost of the carbide used in producing the gas.

It has been said that Ullmann's process resembles that of Frank for the purification of acetylene. Ullmann, however, states that acidified solutions of salts of the metals as used by Frank, retain the impurities owing to the formation of insoluble or non-volatile compounds with the metals, but that chromic acid acts quite differently, in that it oxidises the impurities in place of forming precipitates with them. It has been contended that the active body in Ullmann's process is not chromic acid, but a solution of chromic chromate which is formed from the latter. Dr. Ullmann, however, states that such a solution cannot exist, as, if formed, it would at once decompose into active chromic acid and an inactive chromium salt. Moreover, trials showed that an acidified solution of chrome alum did not completely remove the impurities from acetylene.

In conclusion, it is stated that prior estimates of the cost of purifying acetylene by various processes are unreliable, because neither analyses of the crude gas nor its rate of flow have been given, nor has the purity of the treated gas been proved by trustworthy tests. As reagents for testing the degree of purity of acetylene, Ullmann recommends (1) a 10 per cent. aqueous or feebly acid solution of lead acetate, and (2) a solution of one part of mercuric chloride in 10 parts of 10 per cent. hydrochloric acid. The gas is passed into two wash bottles, containing these solutions in the order named; if it be imperfectly purified, white rings will form on the glass inlet tubes, and ultimately the solutions will become turbid.—J. A. B.

Acetylene Lighting. Stern. J. für Gasbeleucht. 1899, **42**, [16], 262—267.

The author, in a long article accompanied by diagrams, deals with the generation and purification of acetylene gas; its employment as an illuminating and heating agent; and its application in the working of motors.

It is pointed out that the price of carbide has decreased gradually from about 60 pf. per kilo. in 1897 to 40 pf. in 1898 and 35 pf. in 1899. The author states that even the latter price must be considered too high, since the cost of production, in certain cases, only amounts to about 12 pf. per kilo. The high price of carbide is stated to be due to the fact that the trade is in the hands of speculators, who have little interest in the advancement of the acetylene industry, but it appears probable that a change will occur in this respect, as the larger acetylene companies have begun to build their own carbide factories.—A. S.

Electric Furnaces, Description of Borchers' New. Electrician, 1899, **43**, [4], 111—112.

The disadvantages of the usual types of electric furnace, when used for calcium carbide production, are summarised as follows:—

1. Loss of carbide by exposure to air when in a heated condition.

2. Loss of carbon due to same cause.

3. Loss of carbon in form of dust, with waste gases from furnace.

4. Loss of heat contained in the fused carbide.

The improved Borchers' furnace consists of a smelting chamber, with thin walls, enclosed in a water-jacket.

When used for carbide production by resistance heating, the carbon is supplied by the horizontal electrodes, and coarsely ground lime is packed around these. When the necessary temperature is attained, the lime unites with the carbon of the electrodes, and fused calcium carbide flows to the bottom of the furnace.

When arc-heating is desired, the electrodes are placed vertically, one through the hopper by which the furnace is fed, and one through the hinged bottom of the furnace. The furnace is filled and the hopper charged with coarsely ground lime as before. The sizes of the furnace and of the charge are so adjusted that after the carbide block has been entirely fused, it will still be enclosed by layers of unused material.

With both forms the finished block of carbide is left for several hours in the furnace, and the heat which it contains is utilised for steam generation. By use of a series of such furnaces, at intervals of two hours or less, a constant supply of heat for steam purposes can be obtained.

It is claimed for these furnaces that by their use one-fourth of the power hitherto used in carbide production is saved.—J. B. C. K.

Carbon, On the Mode of Burning of. H. B. Dixon. Proc. Chem. Soc. **15**, [209], 118—119.

In the combustion of carbon, the formation of carbon dioxide is usually described as being due to a single and direct action between carbon and oxygen; it is stated or implied that carbon monoxide is only formed by a secondary action between carbon dioxide and carbon. The only experiments which claim to prove this are the two series made by Julius Lang (Zeit. Phys. Chem. 1888, **2**, 168).

The author repeated Lang's experiments, and found that when oxygen was passed over carbon heated to 500° C. (a temperature at which Lang asserted carbon dioxide was not reduced by carbon), even in a very slow stream, some carbon monoxide was always formed.

Under conditions far less favourable for the reduction of carbon dioxide than in Lang's experiments, *viz.*, by passing a mixture of carbon dioxide with 6—8 per cent. of oxygen over carbon heated to 500°, some carbon monoxide was always formed.

Lang's more important argument depends on his second series of experiments, which consisted in passing a mixture of oxygen, carbon monoxide, and nitrogen over carbon at 500°. He found that with a slow stream the carbon monoxide remained unchanged in amount, whilst all the oxygen was converted into carbon dioxide; with a quicker stream, the proportion of carbon monoxide increased considerably, but with a still quicker stream it was much reduced. The author has made many experiments to test these results. When a mixture containing about 80 per cent. of oxygen and 20 per cent. of carbon monoxide, was passed quickly over coke heated to 500° C., the blue flame of burning carbon monoxide was observed, and the amount of that gas found in the products was small. On lowering the rate of the gas stream, the flame was not formed, but the carbon glowed and the amount of carbon monoxide in the products increased. This reached a maximum and then diminished as the rate of the stream was continually lowered. With a very slow stream, from 2—4 per cent. of carbon monoxide was found in the products. These results are quite opposed to the conclusions drawn by Lang, *viz.*, that carbon monoxide is unaltered when, mixed with oxygen, it is passed very slowly over carbon at 500°. His argument that carbon dioxide must be first formed is therefore invalid.

The results of the new experiments might be explained on either hypothesis if it be assumed that the molecule of the monoxide, or of the dioxide, as the case may be, formed by the direct union of the elements at 500° C., retains sufficient heat (from its heat of formation) to react with oxygen or carbon respectively. The experiments of Baker (Phil. Trans. 1888, **179** A, 571) make it very probable that the carbon burns first to carbon monoxide.

PATENTS.

Coke, Process and Apparatus for Making, and Saving By-Products. P. Naef, New York, U.S.A. Eng. Pat. 7953, April 2, 1898. (Under Internat. Convent.)

This invention relates to the manufacture of coke and by-products from carbonaceous fuel, and the simultaneous production of cyanides or ammonia by the action of atmospheric nitrogen on the coke in the presence of an alkali

The inventor claims the production of coke, gas, and by-products, which consists in intimately associating fuel with a small amount of an oxide or carbonate of an alkali or alkaline earth, passing the mixture downward through a shaft, injecting highly heated air into the incandescent fuel in the lower part of the shaft, passing the gases upwards through the fuel, and injecting steam into the fuel some distance above the entrance of the incandescent air. The gases are treated for the recovery of ammonia and cyanide. The coke produced in the part of the apparatus below the entrance of the incandescent gas is treated with steam in order to decompose cyanide into ammonia.

The apparatus comprises a coking chamber above and cooling chamber below, forming a stack, with a contracted neck separating the two, and a ring of hot-air ducts leading into the apparatus at the point of contraction; also heating stoves for heating the air to be forced through the coking material, and washing arrangements to recover the gaseous products.—D. B.

Coke, Process and Apparatus for Making, and Saving By-Products. P. Naef, New York, U.S.A. Eng. Pat. 7952, April 2, 1898. (Under Internat. Convent.)

This specification describes and claims the production of coke, gas, and by-products, which consists in charging carbonaceous fuel into a shaft, withdrawing coke from the same, injecting cold air, hot air, or a heated mixture of air and steam, into the upper part of the shaft, and conducting the hot gases produced by combustion through the said upper part and simultaneously treating the resulting coke with steam by injecting the same at various points in the lower part of the shaft, for the production of ammonia.

There is further claimed the production of coke, by-products, and gas containing a small percentage of nitrogen and comparatively rich in hydrocarbons, the method consisting in heating air in separate air-heating stoves and continuously forcing the hot air into a descending column of fuel, and conducting the hot gases produced by combustion through the same for the purpose of coking the coal.

Part of the heat required for coking may be supplied also by means of heated flues in the sides of the apparatus, another part being furnished by air or a mixture of air and steam previously heated, forced through the coking material, and only the remainder by the combustion of fuel in the coking chamber.

The apparatus, of which various forms and combinations of parts are described and claimed, consists essentially of an upper chamber independently supported for coking the fuel and having means for injecting hot or cold air, a lower chamber for treating the resulting coke with steam and water, a water ring between both chambers, and doors within said ring.—D. B.

Coke, Process and Apparatus for Making, and Saving By-Products. P. Naef, New York, U.S.A. Eng. Pat. 7951, April 2, 1898. (Under Internat. Convent.)

The principal features of the 18 claims set forth by the inventor are:—

The manufacture of coke, which consists in producing hot combustible gases in a separate furnace, and forcing the same *per se* or mixed with steam through a column of coking material.

The production of coke, gas, and by-products, which consists in injecting hot gases into and passing the same through a body of coking material in the upper part of a shaft, whereby the volatile matter is removed, and injecting steam and water into the resulting coke at various heights into the lower part of the shaft, whereby ammonia is formed by decomposition of the nitrogenous compounds of the coke, and the latter is cooled.

A coking apparatus consisting of a vertical or inclined shaft having means for (1) charging fuel on the top, (2) discharging coke at the bottom, (3) conducting hot gases through the upper part, and (4) conducting steam and water through the lower part for the purpose of producing ammonia and for cooling purposes.

A coking apparatus, as above, having the lowest inlets for gaseous fluid at such a distance from the bottom, that the resistance offered to the passage of the gas through the fine fuel above is the same or less than the resistance downwards through the coke, thus enabling the withdrawal of coke to be made, without loss of gas.—D. B.

Ammonia, Cyanides, Coke, and Gas; Process and Apparatus for Producing. P. Naef, New York, U.S.A. Eng. Pat. 9462, April 25, 1898. (Under Internat. Convent.)

A combination of the manufacture of pig-iron in blast furnaces, and the production of coke and valuable by-products.

The method consists in forcing hot gases from blast furnaces through a column of fuel in the presence of steam, which enables the production of large quantities of coke in a single apparatus, to be made, and also the recovery of ammonia from the nitrogenous compounds of the coke. In cases where the cyanides in the blast-furnace gases are to be recovered as such, no steam is introduced into the coking apparatus. The gases are taken from the blast furnace at a height at which little or no destruction of cyanide takes place.—D. B.

Cyanogen, Impts. in the Extraction of, from Coal Gas. J. Bueb, Dessau, Germany. Eng. Pat. 9075, April 19, 1898.

This is a modification of the processes patented by Knublauch (Eng. Pat. 15,164, 1887), and by Rowland (American Patent, 465,600), whereby cyanogen is separated from coal gas, "in the form of a double salt or compound, by means of iron and of alkalis, or of the ammonia contained in the gas itself." These processes involve the use of dilute solutions of iron salts, whereby the cyanogen compound is obtained, not as a precipitate, but in solution. The present improvement consists in using the iron salt in concentrated solution, whereby the cyanogen compound formed, precipitates. The muddy precipitate is "energetically boiled," without the addition of any chemical, to obtain the product in a condition readily converted into marketable cyanogen compounds. The process is carried out by arranging between the cooler, or tar separater, and the ammonia scrubber, one or more chambers containing a concentrated solution of an iron salt. The ammonia contained in the gas assists in the reactions that take place. —E. S.

Regenerative Gas Furnaces and Gas Producers, Impts. in. J. G. Gordon, Westminster. Eng. Pat. 10,044, May 2, 1898.

The gas producer has a solid sloping bottom, with side inlets for entrance of air. The produced gas passes to a dust pocket and thence to the top of the furnace, where it meets with heated air and is burned. After passing the length of the furnace, the products of combustion descend to two parallel longitudinal chambers, and afterwards travel back again by two lower parallel longitudinal chambers to the chimney. The air for combustion enters from a pit, and is heated by passing along two parallel longitudinal flues lying between the upper and lower chambers above mentioned. The heated air then rises by a flue to the inlet of the producer gas to the furnace.—R. S.

Electric Arc Furnaces, Impts. in. P. C. Day and The Acetylene Illuminating Co., Ltd., both of London. Eng. Pat. 13,687, June 20, 1898.

The furnace is formed rectangular in shape, two of the opposite sides being each formed of a number of doors or removable segments, one above the other. In the centre of each segment or door is a hole. One electrode covers the base of the furnace, the other is lowered down to form the arc, and the material—as lime and coke—is packed in excess around the electrodes, the lower door on each side being closed. The furnaceman clears an opening through the central upwardly directed opening in each door, to allow of the escape of the gases evolved, such as carbonic oxide. As the ingot increases in size, first one more door on each side is closed, then another, and so on, till all are closed, whilst fresh holes for the escape of gases are made as required, so that such vent holes are always practically at the level of the arc.—R. S.

Electrically Heating Compact or Pulverised Substances Difficult to Fuse or Infusible, An Improved Process of and Apparatus for. W. Borchers, Aix-la-Chapelle. Eng. Pat. 6061, March 20, 1899.

The inventor claims "a process for the continuous heating of substances in electric furnaces, in which, prior to the substances reaching the arc-zone, they are passed between appropriately arranged electrodes, so as to be first included in the circuit as resistances, and to be thus subjected to a preliminary heating, that may or may not increase in intensity." For carrying out this process, when preparing calcium carbide or heating infusible substances, a furnace is used "presenting this characteristic feature, that a tapering electrode is so arranged at an angle to the adjustable electrode, that the layer of material placed upon the former electrode and moved towards the arc, decreases in cross-section, so that consequently the resistance increases in proportion, whilst in the case of infusible substances, the carbon electrode admits of being moved to and fro, for the purpose of displacing the substances." In this case "carbon blocks or plates are inserted into the feed conduit of the material, opposite the mouth of which conduit two carbon plates with arc electrodes of equal polarity are arranged, whilst a cool and rotatable disc, serving as a support, regulates the descent of the layer of material." When heating continuous slabs of material, there is used a "rigid carbon contact block, over which the slab-shaped material is gradually passed towards and into the arc."—R. S.

Destroying Soot in Chimneys, New or Improved Means for. T. Voile, Leicester. Eng. Pat. 13,711, June 20, 1898.

A chimney-cleaning compound, consisting of a mixture of sulphur, saltpetre, salt, and sawdust or chips, enclosed in zinc tubes, and used by placing in the middle of the fire in a grate.—R. S.

Oil Burners for Lighting or Heating, Impts. in or connected with. J. Gregory, New York. Eng. Pat. 10,897, May 12, 1898.

Among the features comprised in the 24 claims are:—

"A lamp, the combination with the inner and outer tubes having a wick space there-between, the inner tube having an upper straight contracted portion, the connection web of the contiguous ends of the large and contracted portions of the inner tube being inclined and providing an annular shoulder at the base of the contracted portion, of a vertically movable spreader, and a wick-lifter carried by the vertically movable spreader, and provided with numerous teeth thrown into contact with the wick by engagement with said annular shoulder, and adapted to become automatically disengaged from the wick by normally springing into the annular depression formed by the contracted portion of the inner tube, when said teeth pass above the plane of the annular shoulder."

The guide for the lifting rod is "located within the wick tube and formed of a single piece of sheet metal, and consists of a ring, and radial arms having outwardly curved parts, the latter unitedly forming a guide opening for the lifting rod."—C. S.

Oil Lamps or Stoves, Impts. in Atmospheric Burners for. J. H. Woodroffe and J. W. B. Wright, Birmingham. Eng. Pat. 11,743, May 24, 1898.

To prevent the flashing back of the flame, in lamps of the type described in Eng. Pat. 21,924 of 1891, the inventors provide a plate or rim of metal or other material running the whole length of the wick case on the non-burning side of the wick, in order to exclude the external air from the non-burning side of the wick up to the point where the atmospheric combustion takes place.—C. S.

Petroleum Stoves, Impts. in Burners for. W. P. Thompson, Liverpool. From Aktiebolaget Arvid Bôhlmarks Lampfabrik, Stockholm. Eng. Pat. 12,770, June 7, 1898.

The claim is for "a burner for petroleum stoves characterised by the arrangement of a cone or casing surrounding the upper part of a gas-supply pipe passing through the crown, immediately above the upper end of which pipe, there is a horizontal disc, covering the upper end of the cylinder surrounding at some distance, the casing, and the lower edge of which is situated somewhat higher than the lower edge of the casing, and which cylinder is surrounded by an outer casing connected with the burner-crown, which on the upper side is provided with openings through which the gas passing beneath the lower edge of the cylinder and there being ignited, can break out in full flame."—C. S.

Spirit Stoves and the like, Impts. relating to. M. Salomon, Aldenhoven, Germany. Eng. Pat. 10,785, May 11, 1898.

In connection with portable or other spirit stoves, the spirit is converted into the solid form by incorporating it with about 18 per cent. of hard soap and about 2 per cent. of shellac, and is thus rendered portable. —C. S.

Gas Burners, Impts. in. A. Heller, Baltimore, U.S.A. Eng. Pat. 5502, March 14, 1899.

The inventor claims the combination with a casing forming a gas chamber, and having holes in its top and bottom, of tubes depending from the top holes and terminating in the chamber above the bottom holes, and tubes projecting from the bottom holes and terminating in the depending tubes, so as to leave a gas passage from the chamber between the tubes, and a combustion space in the depending tubes, the object being to produce combustion inside the top of the gas chamber or in the depending tubes, "so that each blaze given by such combustion will be solid or compact, without interruption in the body of the blaze as it comes from the top of the burner."—C. S.

Gas Lighter, Improved Automatic. W. P. Thompson and Co., Liverpool. From F. Trendel, Berlin. Eng. Pat. 5554, March 14, 1899.

The appliance consists of a frame carrying a pivoted lever which supports a catalytic substance, and is attached to a spring which abuts with its free end against a fulcrum on the frame, and, by expanding under the influence of the heat of the lighted flame, automatically moves the catalytic igniter away from the said flame, and also enables the igniter to return to its original position when the flame has been extinguished and the spring has cooled down. —C. S.

Burners, Impts. in Atmospheric. W. B. Smith, Chelsea. Eng. Pat. 9313, April 22, 1898.

"An atmospheric gas burner with compartments in which gas and air, after ascending together its most central compartment, descend one or more compartments, and then the bulk of the gas and air is compelled to move more or less horizontally (but not radially), and in such a direction as to encompass or partly encompass the central tube, and then reascend to the top of the burner," ascending and descending compartments being formed between the two principal tubes of the burner—which are mounted one inside the other—"by means of partitions extending from the outer to the inner tube, or nearly so."—C. S.

Gas Burners, Impts. in. G A. Hall, E. Owen, and G. E. Dayton, New York. Eng. Pat. 10,289, May 5, 1899.

The improvements relate to incandescence burners, and comprise a governor, or pressure regulator, consisting of "a tube having therein a diaphragm with a central opening, a needle valve working loosely in said opening, with its pointed end towards the gas supply, and carrying at its lower end a concavo-convex disc, with the concavity facing toward the gas supply, and at its upper end a plane disc, and beyond said plane disc, beyond the range of movement thereof, a perforated diaphragm." This arrangement is in combination with a non-expansible exterior ring or jacket, mounted on a cone-shaped metal ring, and arranged and adapted to serve as a seat for the base of the incandescent mantle.—C. S.

Electric Furnaces, Impts. in Insulating Means for. W. L. Wise, London. From The Aluminium-Industrie Actiengesellschaft of Neuhausen, Switzerland. Eng. Pat. 12,268, May 31, 1898.

The insulation for electric furnaces consists of non-conductors which are alternate with, or traversed by conductors of electricity which are in contact with them, and means are provided for cooling them so that they are maintained at a suitably low temperature by the conductors. Various arrangements of the conductors and non-conductors are described.—G. H. R.

Incandescence Oil Lamps, Impts. in Burners for. O. Imray, London. From Kuhnt and Deissler, Berlin. Eng. Pat. 17,830, Aug. 18, 1898.

Refers to a lamp of the type described in Eng. Pat. 11,803 of 1898. The claims are for an improved construction of the air-distributing head which is fixed centrally within the top of the inner wick-tube. The head consists of a short tubular piece extending above the wick-tubes and provided with a flame-spreading flange, which is surmounted by a conical or tapering hollow body. The flat top of the tapering body is imperforate; its conical surface is perforated; its diameter at the part in contact with the flange is the same as that of the flange; and its diameter at its upper end is less than that of the tubular part below the flange. The tubular part below the flange is provided with oblique or helically-formed slots.—H. B.

Incandescence Oil Lamps, An Impt. in Burners for. T. J. Cranston, Westminster. Eng. Pat. 6948, March 30, 1899.

This refers to a modification of the conoidal part of the flame-spreader described in Eng. Pat. 17,830 of 1898 (see preceding abstract). The conoid is more sharply tapered, and is surmounted by a hemispherical cap having its base projecting laterally beyond the top of the conoid, the projecting part being perforated so as to allow an outward and downward passage of the mixture of air and combustible vapour.—H. B.

Incandescent Electric Lamps, Impts. in Illuminating Conductors for. O. Imray, London. From Carl Auer von Welsbach, Vienna. Eng. Pat. 13,116, June 11, 1898.

This invention relates to "improved types" of filaments for incandescent electric lamps. The patentee finds "that when a mixture is taken of osmium and some refractory oxide or oxides, such as thorium oxide or zirconium oxide, or the oxides of any of the other rare earths, such a mixture can be raised to a very high temperature without the osmium becoming oxidised, and indeed the melting point of these oxides may be reached without any oxidation of the osmium taking place. . . . The bodies formed as above, have a remarkable capacity for resisting high temperatures, especially when the refractory oxide which has been used in the mixture is non-volatile at high temperature."

Finely divided osmium is mixed with a refractory oxide, such as thoria (which may be partially or wholly replaced by zirconia or the yttrium earths), or with a salt which when strongly heated leaves the oxide as a residue, and the whole is kneaded into a uniform paste with a concentrated solution of sugar or other suitable organic substance. For a current of 100 volts suitable proportions would be three parts of osmium to one part of thoria; for currents of higher tension, say 300 volts, the thoria and osmium should be in approximately equal quantities; and the proportion of thoria "must be kept within such limits that the filament will still act as a conductor to a current of the required strength while in a cold condition." The paste is formed into, say, filaments, by forcing it through a die or otherwise; the threads are dried in the air, are next gradually heated in air by passing a current through them till the first products of the combustion of the organic binding material have passed off, and are then gradually raised to incandescence in a reducing atmosphere containing water-vapour, whereby the remaining carbonaceous matter is burnt out, leaving a filament of osmium and the resistant oxide.

It is preferable to use pure osmium, but osmium mixed or alloyed with other platinum metals, such as iridium or ruthenium, may be used. The filaments may be used in lamps filled with a reducing or neutral gas, or they may be enclosed in exhausted bulbs.

The claims are for the process, and for illuminating conductors prepared according to it.—H. B.

Incandescent Electric Lamps, Impts. in Incandescent Bodies for, and in the Process of Manufacturing the same. C. Kellner, Vienna. Eng. Pat. 19,785, Sept. 17, 1898.

The incandescent bodies or filaments claimed have one of the following compositions:—(1.) Infusible metals, such as thorium, which are poor conductors and have "a high capacity for emitting light." (2.) Almost infusible metals, such as titanium (either as metal or as nitride), chromium, or tungsten, or alloys of these. (3.) Mixtures of almost infusible metals, or of graphite of high density, with metallic oxides that are infusible or are fusible with difficulty, and are capable of emitting light, such as thoria with or without ceria. The metals, or the mixtures, are moulded in a state of fine powder into solid bodies, under a pressure of up to 20,000 kilos. per square centimetre, without the addition of a binding or fusing agent. When the filaments have the composition 1 or 2, they are oxidised at their surfaces by glowing them in air, placing them in an oxidising liquid, or inserting them as anodes in an electric circuit by which an electrolyte is decomposed and gives up oxygen as an anion. Bodies of composition 3, containing graphite, may also be made by pressing a mixture of the powdered oxides with a small addition of cellulose which has been distended by soaking in chloride of zinc, and glowing the body in a vacuum or atmosphere of inert gas, such as nitrogen, afterwards converting the amorphous carbon into graphite of high density by passing a current of high potential through the body. The leading wires may be fused into the thickened ends of the filaments. Each of the above processes and products is claimed.—H. B.

Metallic Mantles for Gas Burners, Impts. in or relating to. A. J. Boult, London. From E. Verbeke, Brussels. Eng. Pat. 19,770, Sept. 17, 1898.

The nature of this specification is indicated by the first of the three claims: "A mantle for gas burners, formed of woven or intermeshed metallic wires, the wires constituting the warp threads being formed of an alloy of platinum, iridium and rhodium, and those forming the weft threads of an alloy of platinum, iridium, rhodium and palladium."
—H. B.

Incandescence Mantles or Bodies for Illuminating Purposes, Impts. in the Manufacture of, and in Material for Use in such Manufacture. W. L. Voelker, New Jersey, U.S.A. Eng. Pat. 25,653, Dec. 5, 1898.

Calcium oxide, 20 parts; magnesium oxide, 79¾ parts; cerium oxide, ⅛ part; and chromium oxide, ⅛ part; are mixed together, "dissolved in nitric acid," the solution heated as described in Eng. Pat. 22,625 of 1897 (this Journal, 1898, 36), and finally electrically fused. "The 'Voelkerite' thus produced," is dissolved "in alcohol in the proportion of about 10 per cent. of 'Voelkerite' and 90 per cent. of alcohol," and with this solution a thoria mantle is coated, after burning off, by dipping it upside down into the solution. The claims are for: (1) "The employment of a solution of 'Voelkerite' in alcohol in the above-named proportions as a light-emitting coating for a thorium oxide mantle-skeleton;" (2) "The dipping of the mantle-skeleton in the solution . . . . . with its upper end downward;" (3) A mantle of thoria, "having a coating of light-emitting oxides, which increases in thickness from the base of the mantle upwards;" and (4) "The herein-described improved material or 'Voelkerite' for use in the manufacture of incandescence mantles."—H. B.

Incandescent Oil or Spirit Lamps, Impts. in. E. Petréano, Paris. Eng. Pat. 3769, Feb. 20, 1899.

In the lamp claimed, the inner of the two concentric wick-tubes is a little shorter than the outer one; and within the inner tube, at its upper part, is fixed a short cylindrical air-distributing body, the sides of which are perforated. The cylindrical body is surmounted by an imperforate dome-shaped cover. A metallic conducting rod, fixed axially in the burner, passes through the cover, and serves to conduct heat from the flame within the mantle to the upper part of the central air passage, promoting the vaporisation from the wick and heating the air supply. A cylindrical collar surrounds the wick-tubes and rests upon the gallery, which is provided with two sets of air-inlets; one air current passes between the collar and the wick-tubes, while the other passes between the collar and the chimney.
—H. B.

Incandescence Oil Burners, An Improvement in. W. T. Ellis, Westminster. Eng. Pat. 5765, March 16, 1899.

There is claimed, "in an incandescence oil burner in which a deflecting disc surmounts a central cylinder having oblique lateral openings, the construction of that disc with perforations through its flange."—H. B.

Calcium Carbide and such like Compounds, the Reduction of Metallic Oxides, and the Melting and Refining of Steel and other Metals; Impts. in and connected with the Manufacture of. T. E. T. Woods, Stockwell, and W. A. Byrom, Great St. Helens. Eng. Pat. 10,021, May 2, 1898.

An oxidising or reducing flame is used for any of the above purposes. The gas employed is prepared by filling one or a series of retorts with hydrated iron oxide, preferably mixed with coke, &c., heating it or them to 1,000° F., passing a current of crude hydrocarbon gas through, collecting the evolved gases, then passing a current of steam through the retorts, and allowing the gases now given off to mix in the holder with those previously evolved. This mixture of gases is used in a furnace having a number of blow-pipe burners, the admission of gas and air being regulated as required to obtain an oxidising or reducing flame. The furnace is lined with a mixture of carbon, lime, and tar in equal proportions, when it is to be used for preparing carbide. When intended for reducing metallic oxides, it is lined with a mixture of the oxide to be acted upon with carbon and hydrocarbon. Each burner consists of a group of air pipes connected to an air-compressing or blowing apparatus, each air pipe being surrounded by another pipe connected to the gas supply.—R. S.

Calcium Carbide, Impts. in Methods and Apparatus for the Manufacture of. H. Maxim, New York, U.S.A. Eng. Pat. 25,656, Dec. 5, 1898.

Three or more parallel horizontal electrodes are employed, which are placed above an endless belt which forms the bottom or hearth of the furnace, at or near the back of which the carbide-forming material is fed in. The electrodes are arranged so that they can be moved backwards and forwards longitudinally by an electric motor, the action of which is controlled by the varying resistance of the incandescent carbide produced by the passage of the current, and in its circuit, is an automatic switch for reversing the motion of the electrodes. A small rod of carbon is preferably employed to make electrical contact between them, and becoming incandescent, converts the material next it into carbide, which is formed in a direction at right angles to the current, until the resistance of the carbide produced, falls so low that it is no longer maintained incandescent. The motor then withdraws the electrodes until the carbide conductor becomes so attenuated that it has the required resistance, when the electrodes move forward again and the belt moves with them, so that the carbide conductor is not broken, or its position altered, relatively to the electrodes. Fresh material is fed in, and the process recommences. The carbide-forming material carried forward on the body of the carbide is removed and retained in the furnace by a plough, while two brush rollers, revolvable at different speeds and in different directions, clean the cooled carbide strip as it leaves the furnace —G. H. R.

High Temperatures, and for Producing Calcium Carbide, Refractory Metals, and the like; An Improved Method of Obtaining. W. Borchers, Aix-la-Chapelle. Eng. Pat. 3940, Feb. 22, 1899.

The inventor claims "The improved method of producing calcium carbide, refractory metals, and the like, consisting in creating the temperature necessary for the reaction by the combustion of carbonaceous fuels (directly surrounding the substances to be treated and in immediate proximity thereto) in air enriched to 30 to 50 per cent. of oxygen and previously heated to about 400° C., the combustion being regulated so that it only forms oxide of carbon, and that the formation of carbonic acid and water is avoided." No apparatus is claimed, as when the above conditions are adhered to, the simplest ordinary furnaces may be used. Four forms are, however, illustrated and described "as examples, while not in themselves novel types."—R. S.

Oxygen Gas, Impts. in Apparatus for the Generation of. W. Blackie, London. Eng. Pat. 9772, April 28, 1898.

The apparatus is portable, and intended for use with the oxy-hydrogen lime-light. A case is fitted with a gas bag, which supports a water-containing platform or tank, affording the necessary pressure. Upon the platform, a hollow central pillar is mounted, fitted with a swivel head, to which are fixed a number of radial tubes or retorts, capable of revolving gas-tight around the pillar, a lamp being so placed that each retort in turn is brought over it to be heated. Each retort consists of a thin cylindrical casing, enclosing a small perforated tube, axially mounted, connected to the gas passage in the pillar. Discs, one attached to the inner tube and one loose, close the ends of the retort, which is charged with annular cakes of the usual mixture of potassium chlorate and manganese oxide. The gas, as it is evolved, passes into the central tube, and thence through the hollow pillar into the hollow water-containing platform, and, washed by contact with the water, ascends a valve pillar to which the lime-light jet is fixed, and in which is also a tube leading to the gas bag (through the tank) carrying the surplus gas to inflate the bag.—E. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Petroleum in the Transcaspian District. K. W. Charitschkoff. Chem. Rev. Fett- u. Harz-Ind. **6**, [3], 49—51.

The large amount of paraffin found in Tscheleken petroleum (this Journal, 1896, 583) is also characteristic of nearly all the mineral oil obtained on the east coast of the Caspian Sea.

The Nephte-Dag oil-field exhibits all the signs of an oil region, a number of sulphur springs, deposits of bitumen (kir), and gas wells being found all round the hill. Although not on a par with the Baku fields, this district is likely to be a profitable one, there being a good local market for the products.

The crude oil has a specific gravity of 0·8736, and flashes below 10°. It contains: carbon, 86·64 per cent.; hydrogen, 12·44; nitrogen, 0·14; ash, 0·05; and oxygen (by difference), 0·37 per cent. The following fractions were obtained by distillation in a copper still:—

Boiling Point.	Per Cent.	Specific Gravity.	Flashing Point.
Up to 100° C.	0·3	..	.. ("benzine").
100°—150°	4·8	0·754	.. ("ligroin").
150°—270°	17·9	0·8171	23° ("kerosene").
270°—310°	7·8	0·840	50° ("solar oil").

The residuum at 270° has a viscosity represented by 5 mins. 37 secs. (Engler) at 50° C.; sp. gr. 0·907; flashing point (Pensky-Martens), 134° C. That remaining at 310° C. gives the following constants, in the same order: 7 mins. 9 secs.; 0·9144; 150° C. The proportion of burning oil ("kerosene") is low, and must be still further reduced to about 15 per cent., to obtain an oil of satisfactory flashing point. It is, however, easy to purify and makes good oil; when refined with 1 per cent. of acid the colour is W.W. 1·75. The yield may be increased to about 22 per cent. by adding the fraction 270°—310° C., but the product is only of second quality, though it burns satisfactorily in lamps.

The residuum solidifies at 12° C., and contains 4 per cent. of paraffin. The calorific power (calculated from the composition: C = 86·21 per cent.; H, 12·41; N, 0·17; S, 0·02; O, 1·21; ash, 0·15 per cent.) is 10,556, and therefore equal to that of Baku residuum. When freed from paraffin, the solidifying point falls to − 5° C.

On distilling the residuum with steam, four fractions were obtained, but proved unsuitable for lubricating oils on account of their low viscosity; in other respects they resemble American "paraffin oils." The highest and largest fraction (36·15 per cent.) is almost solid at the ordinary temperature, and, when refined with acid and decolorised with bone black, forms an excellent vaseline. The final tarry residue (sp. gr. 0·960) resembles pitch, and can be utilised in various ways.—C. S.

Benzene, Action of Peroxide of Hydrogen on. F. S. Young. Proc. Chem. Soc. **15**, [210], 131—132.

As the result of some preliminary experiments, the author had found that, although hydrogen peroxide by itself attacks benzene only very slowly, an extremely energetic reaction takes place in the presence of ferrous salts. A complete examination of the products of the reaction has still to be made; but he had proved that a considerable quantity of phenol is formed.

In two preliminary experiments, in which one molecule and two molecules of hydrogen peroxide were used for one molecule of benzene, the yields of phenol were 10 per cent. and 20 per cent. respectively; and it is possible that these yields may be increased when the most favourable conditions for its formation have been determined. Pyrocatechol was also obtained as a product of the reaction.

Acetic Acid, Separation and Estimation of, in Commercial Acetates. K. R. Haberland. Zeits. anal. Chem. 1899, **38**, [4], 217.

See under XXIII., *page* 613.

IV.—COLOURING MATTERS AND DYESTUFFS.

Eriococcus Coriaceus, The Colouring Matter of; and the Wax of Ceroplastes Rubens. E. H. Gurney. Rep. of the Australasian Assoc. for the Advancement of Science, Sydney, 1898. Section B. 273—275.

Eriococcus coriaceus.—A scale insect occurring in closely-packed clusters of small pinkish-white sacs, encasing the stems of young shoots of the eucalypti, especially those springing from old or burnt stumps. The colouring matter extracted, when dyed on wool and silk mordanted with aluminium, tin, chromium, and iron, gave a light amber, light orange-brown, brown, and sage-green shades respectively. The colours obtained, possessed no particular brilliancy or distinctiveness, and were in no case fast to alkalis.

Ceroplastes rubens.—Pinkish-white scale which floats on water. By heating the scale and straining through a fine cloth, 38 per cent. of wax was obtained; whilst by using solvents, 83 per cent. was obtained with absolute alcohol, 86 per cent. with ether, and 88 per cent. with petroleum spirit (benzine). The heat-extracted wax melted at 60° C., that extracted by solvents at 55° C. The purified wax had the following composition: 78·22 per cent. of carbon, 11·01 per cent. of hydrogen, and 10·77 per cent. of oxygen; and its probable composition is therefore $C_{10}H_{17}O$.

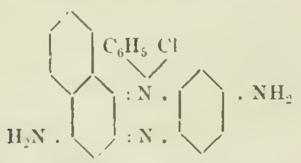
The wax was compared with that from *Ceroplastes ceriferus.*

——	Melting Point.	Specific Gravity.	Probable Composition, calculated from Percentage Composition.
Ceroplastes ceriferus	60° C. 55° C.	1·04 at 15° C.	$C_{13}H_{26}O$.
Ceroplastes rubens..	60° C. 55° C.	1·03 at 23° C.	$C_{10}H_{17}O$.

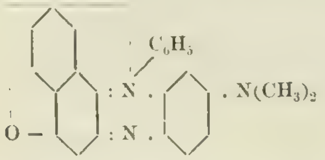
—A. S.

9 *Acetamidophenylisonaphthophenazonium, Action of Amines on the Salts of* [*Prasindones*]. F Kehrmann and W. Aebi. Ber. **32**, [6], 932—938.

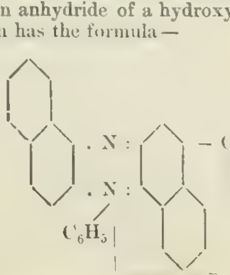
The chief product of the action of 4-acetamido-1.2-naphthoquinone on the hydrochloride of phenyl-*o*-phenylene diamine is the compound referred to in the title. This substance reacts readily with amines, which enter the position 3. For example, ammonia forms 9-acetamido-3-amido-phenylisonaphthophenazonium, which on hydrolysis yields the corresponding diamine, having the formula—



In this and analogous substances obtained by reacting with other amines, the amido group in 9 is replaced by boiling with dilute mineral acids by the hydroxyl group, and salts of 9-hydroxy-3-amidophenylisonaphthophenazonium are formed. This product, however, in a free state, forms a rosinduline-like anhydride belonging to a new series. For example, 9-hydroxy-3-dimethylamido-phenylisonaphthophenazonium in the form of base has the formula—



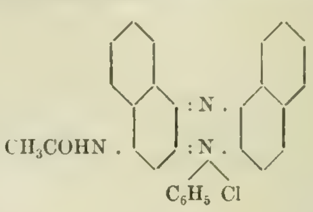
Whilst the inner anhydrides of the hydroxyazonium bases hitherto known, possess a 5-member ring containing oxygen, and are red to reddish-violet, the new anhydrides have a similarly constituted 6-member ring, and are coloured bluish-green to pure green. In view of these properties and their analogies to the rosindones, the author terms them "Prasindones." The simplest non-amidated prasindone is the emerald-green anhydride of a hydroxyphenylisodinaphthazonium, which has the formula—



and is described in the following abstract. The authors in their present paper give details of the action of ammonia, dimethylamine, and aniline on 9-acetamidophenylisonaphthophenazonium, the two former condensation products (after hydrolysis and substitution of the amido by the hydroxyl group) yielding amidoprasindone derivatives, whilst it is not yet certain whether the aniline derivative gives a prasindone or a rosindone anhydride.—T. A. L.

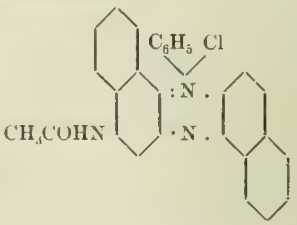
Naphthinduline and Naphthazonium Compounds. F. Kehrmann and W. F. Sutherst. Ber. **32**, 939—947.

Phenyl-*o*-naphthylene diamine hydrochloride condenses with 4-acetamido-β-naphthoquinone, forming the acetyl compounds of Fischer and Hepp's naphthinduline (which is in fact an amido derivative of phenyldinaphthazonium) and also of an amidophenylisodinaphthazonium. The latter, when boiled with dilute acids, loses the amido group in exchange for hydroxyl, forming, as already mentioned in the preceding abstract, dinaphthophenylprasindone. The condensation is effected by dissolving 9 grms. of the quinone and 10·25 grms. of the hydrochloride in 70 c.c. of 95 per cent. acetic acid. After standing about four days at the ordinary temperature the greater part of the sparingly soluble acetamidophenyldinaphthazonium chloride separates out. It has the formula—

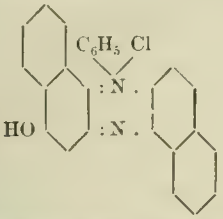


and crystallises from alcohol in brick-red shining greenish needles soluble in hot alcohol and acetic acid, with a yellowish Eosine-red colour. The dilute alcoholic solution shows a strong orange-yellow fluorescence. Concentrated sulphuric acid dissolves the crystals to a violet-blue solution, which changes to yellowish Eosine-red on diluting with water. On hydrolysis in an alcoholic solution with dilute sulphuric acid the authors obtained salts of amidophenyldinaphthazonium, which base is identical with Fischer and Hepp's naphthinduline (Annalen, **272**, 332; this Journal, 1893, 669). If the amido group be removed by means of the diazo reaction, a theoretical yield of phenyldinaphthazonium chloride is obtained. This forms reddish-brown golden needles, tolerably soluble in hot water and alcohol, the latter solution showing a yellowish-green fluorescence and an orange-red colour. The salt dissolves in concentrated sulphuric acid with a pure blue colour, turning orange-red on adding water.

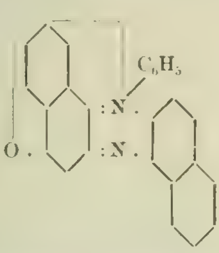
The more soluble chloride obtained in the condensation above, has the formula—



and crystallises from alcohol in brick-red matted needles, readily soluble in acetic acid and water, to red non-fluorescent solutions. Concentrated sulphuric acid dissolves the crystals to a violet-blue solution, which, on adding water, becomes dark green and then red. On hydrolysis with dilute sulphuric acid and decomposition of the sulphate obtained, with salt, the chloride forms green needles soluble in alcohol with a greenish-blue, and in water with a violet-blue colour, but neither solution shows any fluorescence. Concentrated sulphuric acid gives a violet-blue solution, which, on adding water turns green, brownish-yellow, and finally violet-blue. On removing the amido group, a yellow fluorescent azonium compound is obtained, which has not et been investigated. If the amido compound be boiled for ome time with an excess of a mineral acid, the amido roup is replaced by hydroxyl, forming a salt of hydroxy-henylisodinaphthazonium—



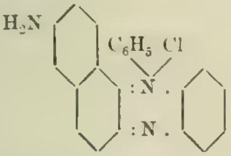
The chloride forms chocolate needles which dissolve in water and alcohol to red solutions. Concentrated sulphuric acid dissolves the salt with a bluish-violet colour, which changes to bright red on adding water. On adding ammonia or an alkali carbonate to a solution of a salt, an emerald-green crystalline precipitate of dinaphthoprasindone is obtained having the formula—



and crystallising from alcohol in shining bluish-green plates. When treated with acetic anhydride the acetate of acetoxyphenylisodinaphthazonium is formed, which gives the nitrate on carefully adding dilute nitric acid. This salt, after purification, forms metallic brownish-red plates easily soluble in water and alcohol, with a yellowish-red colour and a strong yellow fluorescence.—T. A. L.

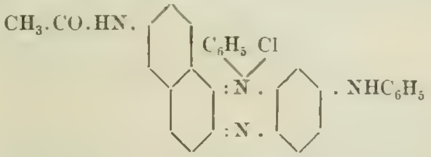
Rosinduline, The Seventh Isomeride of. F. Kehrmann and M. Ravinson. Ber. **32**, [6], 927—932.

By condensing 3′-acetamido-1.2-naphthoquinone (Ber. **31**, 2413; this Journal, 1899, 31) with phenyl-*o*-phenylene diamine there results the acetyl derivative of 7-amidophenylisonaphthophenazonium chloride, which, on hydrolysis, yields the chloride of 7-amidophenylisonaphthophenazonium (Isorosinduline No 7)



Amines react with the acetyl derivative, replacing the hydrogen in the position 3, para to the trivalent nitrogen. 5 grms. of 3′-acetamido-1·2-naphthoquinone suspended in 100 c.c. of alcohol are mixed with 5·1 grms. of *o*-amidodiphenylamine hydrochloride dissolved in as little alcohol as possible, together with a few drops of hydrochloric acid. The condensation is moderated by cooling, and finally the reaction is completed by heating on the water bath. The chloride which separates out with a yield of 90—95 per cent., is purified by dissolving it in water and, after filtering, adding dilute hydrochloric acid. It forms orange-yellow shining granular crystals which dissolve in hot alcohol to an orange-red solution, with a distinct yellow fluorescence. On heating the aqueous solution of the salt with dilute hydrochloric acid until the colour turns to a pure violet, and adding salt, the hydrochloride of the hydrolysed base separates in coppery plates readily soluble in water and alcohol, to pure violet solutions. The amido group is removed by dissolving the chloride in 50 per cent. sulphuric acid, adding nitrite solution, and then twice the volume of alcohol. When the evolution of nitrogen has ceased, the addition of ferric chloride precipitates a reddish-brown crystalline iron double salt, which dissolves in alcohol without any fluorescence and turns blue on adding dimethylamine. These reactions are those of the iron double salt of phenylisonaphthophenazonium, and hence the isorosinduline described, is an amido derivative of this substance. It follows also that the acetamidonaphthoquinone employed, is really a *β*-naphthoquinone derivative.

It would appear that the new isorosinduline does not react directly with amines, whilst the acetyl derivative readily reacts. For example, aniline gives the compound—

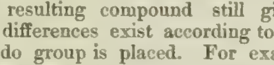


from which the acetyl group can be split off by boiling the blackish-blue alcoholic solution with some hydrochloric acid until the colour has become pure blue. Ammonia acts in the same way, although an indifferent yield is obtained, the acetyl chloride forming shining dark-red crystals soluble in water and alcohol, with a dark blood-red colour and a fiery-red fluorescence. On hydrolysis with hydrochloric acid the product dissolves with a pure violet colour in water and alcohol.—T. A. L.

Azo Dyestuffs of the Benzimidazol Series, Substantive. J. Pinnow and F. Wiskott. Ber. **32**, [6], 898—915.

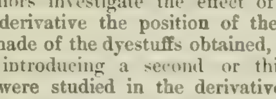
It has been shown that even if oxygen or the imido group be substituted for the sulphur in dehydrothio-*p*-toluidine the resulting compound still gives cotton azo dyestuffs, but differences exist according to the position in which the amido group is placed. For example, *m*-amidophenylmethylimidazol gives much weaker dyestuffs than those derived from the para compound. In the present paper the authors investigate the effect of altering in the benzimidazol derivative the position of the azo group, its effect on the shade of the dyestuffs obtained, and the change produced by introducing a second or third azo group. These points were studied in the derivatives of *a*-phenyl-*N*-benzylbenzimidazol, which were obtained by condensing *m*-nitrobenzaldehyde and benzaldehyde with nitrophenylenediamine ($NO_2:(NH_2)_2 = 1:3:4$) in an acid solution, and also from nitrobenzaldehyde and *o*-phenylenediamine. The nitrophenylenediamine was obtained by nitrating acetanilide, recrystallising the product from alcohol, hydrolysing with alcoholic potash, and recrystallising from acetic ether; the yields being 63 grms. of recrystallised dinitracetanilide from 50 grms. of acetanilide, giving 45 grms. of *a*-dinitraniline. The reduction with ammonia and sulphuretted hydrogen gave 55—60 per cent. of nitro-*o*-phenylenediamine, calculated on the dinitraniline taken.

When nitro-*o*-phenylenediamine hydrochloride is condensed with benzaldehyde in an alcoholic solution, two products are formed, *N*-benzyl-*a*-phenylnitrobenzimidazol—



$$O_2N.C_6H_3\left\langle\begin{matrix}N-CH_2C_6H_5\\ N\end{matrix}\right\rangle C.C_6H_5$$

(light yellow prisms from benzene melting at 188° C.), and *a*-phenylnitrobenzimidazol—

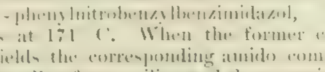


$$O_2N.C_6H_3\left\langle\begin{matrix}NH\\ N\end{matrix}\right\rangle C.C_6H_5$$

(white lancet-shaped needles melting at 203° C.), the former being soluble and the latter insoluble in potash-lye, but the former also probably existing in two forms. On reducing the former with stannous chloride, *N*-benzyl-*a*-phenylamidobenzimidazol is obtained in white prisms melting at 192° C. The base gives a diazo compound when treated with hydrochloric acid and nitrite, and combines with phenol to form a yellow crystalline azo compound melting at 273° C. If the *a*-phenylnitrobenzimidazol be reduced in a similar manner it yields α phenylamidobenzimidazol in plates which do not melt at 280° C. This base can also be diazotised, and gives azo dyestuffs with dimethylaniline, α naphthol, and *m*-phenylenediamine hydrochloride.

On condensing *o*-phenylenediamine hydrochloride with *m*-nitrobenzaldehyde in aqueous alcoholic solution, two compounds result, *m*-nitro-α-phenylbenzimidazol, melting at 205° C., insoluble in alkalis, and dinitrobenzaldehydine or α nitro-*N*-phenylnitrobenzylbenzimidazol, $C_{20}H_{14}N_4O_4$, which melts at 171° C. When the former compound is reduced it yields the corresponding amido compound crystallising in needles from aniline and decomposing at 220°—250° C. The base also yields azo dyestuffs. On reducing the dinitro compound it forms the corresponding base melting at 194° C., which gives a diacetyl compound melting at 219° C. When treated with nitrite and hydrochloric acid, both amido groups are diazotised and will combine with phenylenediamine.

The condensation of nitro *o*-phenylenediamine and *m*-nitrobenzaldehyde gives rise to the production of *N*-nitro-benzyl-α-nitrophenylnitrobenzimidazol—



in prisms melting at 236° C., and also of α-nitrophenylnitrobenzimidazol, in prisms melting at 283° C., the former probably existing in two different isomeric modifications. On reduction, the trinitro compound yields triamidobenzaldehydine, a non-crystalline base. The triacetyl derivative melts at 179° C., and the base, when treated with nitrite and acid, gives a trisazo dyestuff when combined with naphthol. When nitrophenylnitrobenzimidazol is reduced, the reaction takes an abnormal course, and provisionally the authors regard the product obtained, $C_{13}H_{12}N_4O$, as oxydiamidophenylbenzimidazol. With regard to the dye tests carried out with the different dyestuffs, the following conclusions were arrived at:—1. The affinity for cotton increases with the number of azo groups, so that cotton dyed with benzaldehydintrisazo-α-naphthol is fast to a 1 per cent. boiling soap solution. 2. The affinity is greater in those dyestuffs in which an azo group is present in the benzimidazol ring, as compared with those in the α-phenyl or *N*-benzyl group. 3. Dyestuffs containing an azo group in the benzimidazol ring give brown or bluish-brown shades; those with it in the two other phenyl rings give more yellow or reddish-brown shades.—T. A. L.

"*Scoparin.*" A. G. Perkin. Proc. Chem. Soc. **15**, [209], 123.

SCOPARIN, the colouring matter of broom (*Spartium Scoparium L.*) was discovered by Stenhouse (Annalen, 1851, **78**, 17), who assigned to it the provisional formula $C_{21}H_{22}O_{10}$. Hlasiwetz (Annalen, 1866, **138**, 190) included scoparin in the quercetin group, for, on fusion with alkali, it gave phloroglucinol and protocatechuic acid.

The similarity of the dyeing properties of scoparin and vitexin pointed to their close relationship (this Journal, 1898, 1138). The results of Stenhouse and Hlasiwetz (*loc. cit.*) have been confirmed, as analysis gave C = 57·60, H = 5·09, and fusion with alkali at 220°, phloroglucinol and protocatechuic acid. Digested with hydriodic acid, one molecule of methylic iodide is evolved, and a new colouring matter, *scopareīn*, results, distinguished from scoparin by its strong tinctorial properties. With boiling potassium hydrate solution, scoparin gives phloroglucinol, vanillic acid, and a third substance, $C_9H_{10}O_3$, colourless needles, melting point 114°. As this latter contains one methoxy group, reacts with semicarbazide, and on fusion with alkali gives protocatechuic acid, it is a *dihydroxyacetophenonemonomethyl ether* (probably $OH : OCH_3 : COCH_3 = 1 : 2 : 4$). Solutions of vitexin and scoparin in sulphuric acid, when heated, both develop a dull-green coloration. The former, by decomposition with alkali, gives *p*-hydroxyacetophenone and phloroglucinol, and it is thus very probable that scoparin is a *methoxy-vitexin*. The author intends to investigate this colouring matter further.

Organic Dyestuffs, Spectroscopic Analysis of. J. Formánek. Zeits. f. Nuters. d. Nahr- und Genussmittel, **2**, 1899, 260.

See under XXIII., *page* 611.

Sandmeyer's and Gattermann's Reaction, An Electrolytic Modification of. E. Votoček and E. Zenišek. Zeits. für Elektrochem. **5**, [43], 1899, 485.

See under XXIII., *page* 612.

PATENTS.

Ortho-Chlor-Benzaldehyde and its Separation from Ortho-Nitro-Benzaldehyde, Impts. in the Manufacture of. G. W. Johnson, London. From Kalle and Co., Biebrich-on-the-Rhine, Germany. Eng. Pat. 11,260, May 17, 1898.

THE process described in Eng. Pat. 15,179 of 1888 (this Journal, 1889, 772), for obtaining *o*-nitrobenzaldehyde by oxidising *o*-nitrobenzyl alcohol, or *o*-nitrobenzyl ethers, has in the present specification been applied to the production of *o*-chlorobenzaldehyde from the corresponding ethers or alcohol. The preparation of these latter is described in Eng. Pat. 11,259 of 1898. The following is one of the examples given:—A mixture of 142 kilos. of *o*-chlorobenzyl alcohol, and 600 kilos. of sulphuric acid (55° B.) are well agitated in a closed vessel at about 40° C., 120 kilos. of a mixture of nitric and sulphuric acids (40 per cent. HNO_3) being then slowly run in. When the evolution of nitrous acid has ceased, the melt is run into 600 litres of cold water. The *o*-chlorobenzaldehyde separates from the acid liquor which is drawn off. The aldehyde is washed with sodium carbonate solution, and finally with water. It melts at 10°·5 C. It is not necessary to start from the pure ethers or alcohol, as the mixture of *o*-chloro- and *o*-nitrobenzyl ether, or a mixture of the two substituted benzyl alcohols, gives a mixture of *o*-chloro- and *o*-nitrobenzaldehyde on oxidation. These two products can be separated by steam distillation and crystallisation, since *o*-nitrobenzaldehyde is solid at ordinary temperatures and scarcely volatile with steam, whilst *o*-chlorobenzaldehyde is liquid and very easily distils with steam.—T. A. L.

Colouring Matters [Red, Blue] therefrom, Impts. in the Manufacture of Intermediate Products and. Read Holliday and Sons, Ltd., J. Turner, and H. Dean, Huddersfield. Eng. Pat. 12,085, May 27, 1898.

THIS specification is supplementary to Eng. Pats. 13,999, of 1897, and 11,736 of 1898 (this Journal, 1898, 572, and 1899, 489), which refer to the production of chloronaphthylamine sulphonic acids by nitrating and reducing the 1.4 and 1.4′-chloronaphthalene sulphonic acids. The acids have the constitutions $NH_2 : SO_3H : Cl = 1 : 1' : 4', 1 : 4' : 1', 1 : 1' : 4$, and $1 : 4 : 1'$. The patentees now find that these acids, by means of the diazo reaction, may be converted into the corresponding chloronaphthol sulphonic acids, which on combination with diazo and tetrazo compounds yield dyestuffs giving bluer shades than those obtained from the unchlorinated naphthol sulphonic acids 1.4, 1.4′, or 1.1′. Moreover, on heating with caustic soda lye (30° B.) under pressure, the chlorine may be replaced by hydroxyl, leaving the sulphonic acid groups intact. The amidohydroxynaphthalene and dihydroxynaphthalene sulphonic acids so obtained, yield dyestuffs when combined with diazo or tetrazo compounds. The patentees further find that certain other chlorine derivatives of naphthalene and naphthylamine sulphonic acids give valuable products when treated in a similar manner. For example 1.1′.3.3′. chloronaphthylamine disulphonic acid can be converted into the corresponding chloronaphthol disulphonic acid. If these products be heated with caustic alkalis they are converted into 1.1′.3.3′. amidonaphtholdisulphonic acid and 1.1′.3.3′. dihydroxynaphthalene sulphonic acid respectively, and in the same way the 1.1′.3.3′. and 1.1′.4.3′. chloronaphthalene trisulphonic acids yield the corresponding dihydroxynaphthalene disulphonic acids. All the intermediate products so

obtained, may be used for the preparation of dyestuffs. For the preparation of a chloronaphthol sulphonic acid, 100 kilos. of 1.1′.4′. chloronaphthylamine sulphonic acid are converted into the diazo compound and slowly added to a boiling solution of 10 per cent. sulphuric acid and the boiling continued until the evolution of nitrogen has ceased. The chloronaphthol sulphonic acid may then be separated, or the solution made alkaline and used directly for the manufacture of dyestuffs. If the same amount of chloronaphthylamine sulphonic acid be heated in an autoclave with 300 kilos. of caustic soda lye (30° B.) to about 220° C. for 2—3 hours, and subsequently acidified with hydrochloric acid, a precipitate of 1.1′.4′. amidonaphthol sulphonic acid is obtained. Similarly, dihydroxynaphthalene disulphonic acids may be obtained from chloronaphthalene trisulphonic and from chloronaphthol disulphonic acids. On combination with various diazo and tetrazo compounds dyestuffs are obtained giving bluish-red and also blue-black shades. The usual series of combinations may be made, employing, in the case of tetrazo compounds, two molecular proportions, either of the same or of different components.
—T. A. L.

Electrolytic Reduction of Nitro-benzol, Nitro-anisol, Nitro-aniline and their Homologues to Azo and Hydrazo-compounds, A Process for the. K. Elbs, Giessen, and A. Wulfing, Elberfeld, Germany. Eng. Pat. 12,596, June 4, 1898.

INSTEAD of rendering the cathode liquid strongly alkaline in the electrolytic reduction of nitrobenzene, nitranisol, nitraniline and their homologues, which is destructive to the diaphragms and promotes the production of resins, the patentees make use of sodium acetate in order to promote electrical conductivity in the cathode cell. For example, 1 kilo. of *o*-nitrotoluene and the same weight of sodium acetate are dissolved in 8 kilos. of boiling 70 per cent. alcohol and subjected in the cathode cell with a cathode of iron or nickel gauze to 780 ampère-hours with a current density of 1,000—1,600 A per square metre (reduction to *o*-azotoluene), and then to 200—210 ampère-hours with a current density decreasing from 200 to 100 A per square metre. A portion of the alcohol is then distilled off, and on cooling, about 85 per cent. of the theoretical yield of nearly pure *o*-hydrazotoluene crystallises out sufficiently pure for the preparation of tolidine. If *m*-nitraniline be electrolysed in the same way but with only one-fourth the amount of sodium acetate, the final product is a new compound, *m*-diamidohydrazobenzene, forming microscopic white pyramids melting at 150° C. It is very sparingly soluble in alcohol, and almost insoluble in water and ether. On treating it with hydrochloric acid it yields *m*-diamidobenzidine identical with the product described by Täuber (Ber. 23, 797) and obtained from *m*-dinitrobenzidine.—T. A. L.

Aromatic Compounds by Means of Hydrocyanic Acid, and certain Derivatives thereof, The Manufacture of. H. E. Newton, London. From The Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 13,453, June 16, 1898.

THE patentees previously discovered that by acting with hydrochloric and hydrocyanic acids in presence of aluminium chloride on aromatic hydrocarbons, phenolic ethers, or similar bodies, so-called aldimides are formed which, by the action of acids, are converted into aldehydes. They now find that free phenols or acid phenolic ethers react in the same way, producing hydroxyaldehydes. For instance, an ice-cold mixture of 20 kilos. of phenol, 20 kilos. of dry hydrocyanic acid (boiling at 27° C.), and 30 kilos. of aluminium chloride, the latter being gradually added, is treated with dry hydrochloric acid gas for about three hours in the cold, and the temperature is then allowed to rise slowly to 50° C. The melt is poured on to ice, boiled for a short time with dilute hydrochloric acid, and the *p*-hydroxybenzaldehyde is extracted with ether, and separated by means of the bisulphite compound. The reaction can also be performed without the presence of aluminium chloride, especially if the phenol contains more than one free hydroxyl group. If, instead of employing hydrocyanic and hydrochloric acids, the so-called sesquihydrochloride of hydrocyanic acid ($2CNH.3HCl$) be caused to act on aromatic hydrocarbons, phenols, or phenolic ethers in presence of aluminium chloride, the reaction proceeds differently, forming, in the case of benzene, benzhydrylamine $(C_6H_5)_2:CH.NH_2$. For example, 12 kilos. of benzene and 10 kilos. of the sesquihydrochloride of hydrocyanic acid are slowly mixed with 10 kilos. of aluminium chloride. When the evolution of hydrochloric acid gas has ceased, the melt is poured on to ice, when an intermediate product having the formula $HN:CH.NH.CH(C_6H_5)_2$ separates in colourless crystals. On boiling it with caustic soda lye until ammonia is no longer given off, benzhydrylamine separates as an oil. The reaction takes a similar course if tertiary amines be employed. Thus, with dimethylaniline and the sesquihydrochloride, the leuco base of auramine is formed, which, however, immediately reacts with a third molecule of dimethylaniline, producing the leuco base of Crystal Violet. The quantities employed are as follows :—15 kilos. of dimethylaniline and 5 kilos. of the sesquihydrochloride are heated for five hours to 130° C. The melt is then dissolved in water made alkaline with soda lye and steam distilled. The unchanged dimethylaniline passes over, and the leuco base of Crystal Violet separates in a pure state.—T. A. L.

Acetylleucomethylene Blue, and of Acetylleuco-ethylene Blue, Manufacture of. O. Imray, London. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 13,724, June 20, 1898.

See under XX., page 606.

Aromatic Para-amido Aldehydes and their Derivatives of Substitution, Manufacture and Production of. T. R. Shillito, London. From J. R. Geigy and Co., Basle, Switzerland. Eng. Pat. 17,135, August 9, 1898.

ACCORDING to this invention it is possible to introduce the aldehyde group into any primary, secondary, or tertiary amine having a free para position. The process depends upon the interaction of an amine, formaldehyde, and an aromatic hydroxylamine. The anhydro compound obtained is then decomposed with acids or alkalis, forming an aldehyde corresponding to the amine and an amine corresponding to the hydroxylamine. For example, the interaction of dimethylaniline, formaldehyde, and *m*-sulpho-*p*-tolylhydroxylamine yields the compound—

$$(CH_3)_2N.C_6H_4.CH:N.C_6H_3.CH_3.SO_3H$$

which on decomposition with alkalis or acids splits up into *p*-dimethylamidobenzaldehyde and *o*-sulpho-*p*-toluidine. The hydroxylamine derivatives may be obtained according to the processes described in Ger. Pats. 84,138 and 89,978, by acting with zinc dust on the sulphonic acids of nitrobenzene and *o*- and *p*-nitrotoluene in neutral aqueous solution in presence of certain salts, such as ammonium or calcium chloride. The following is a typical example of the formation of an aldehyde :—A cold solution of 36 kilos. of dimethylaniline in 45 kilos. of hydrochloric acid (21° B.) and 22·5 kilos. of formaldehyde (40 per cent.) is mixed with an acid solution (about 600 litres) of *m*-sulpho-*p*-tolylhydroxylamine obtained from 100 kilos. of sodium *p*-nitrotoluene sulphonate. The mixture turns deep orange, and a yellow precipitate of the anhydro compound separates. After 48 hours this is filtered off, washed, dissolved in ammonia, and boiled, when dimethyl-*p*-amidobenzaldehyde separates in oily drops, which solidify on cooling. On recrystallisation from water, the aldehyde melts at 73° C. The preparation of a large number of aldehydes is described in the specification, together with their characteristics.—T. A. L.

Colouring Matters [Bluish-Violet, Blue, Greenish-Blue] of the Rosaniline Series, Impts. in the Manufacture of. T. R. Shillito, London. From J. R. Geigy, Basle, Switzerland. Eng. Pat. 27,372, Dec. 28, 1898.

THE process described in Eng. Pat. 17,135 of 1898 (see preceding abstract) renders easy the production of *o*-substituted *p*-amido-aldehydes, and hence the preparation of dyestuffs of the Malachite Green series containing groups ortho to the

methane carbon, which have such an important influence both as regards shade and resistance to alkalis. It is also observed that with the introduction of each successive group in the ortho position the shade passes from violet through blue to green. Moreover, the effect of two ortho substituting groups is the same whether they are in the same or in different benzene rings, and whether the substituting groups are methyl or chlorine groups. For example, 16·4 kilos. of dimethyl-*p*-amido-*o*-tolylaldehyde, 30 kilos. of dimethylaniline, and 30 kilos. of concentrated hydrochloric acid are cohobated in a lead-lined vessel for 10—15 hours. When the aldehyde has all been taken up (reaction with *p*-phenylenediamine), sodium carbonate solution is added and the excess of amine is driven off with steam. The grey granular leuco base is filtered, washed, and dried. In order to oxidise it, 38·7 kilos. are dissolved in 43·5 kilos. of hydrochloric acid (28·6 per cent.) and 4,000 litres of water, and oxidised with 119·5 kilos. of lead peroxide paste (19 per cent.). After two hours, 25 kilos. of sodium sulphate are added, the whole is heated to 80° C., filtered from lead sulphate, and precipitated with salt. The dyestuff forms bronzy laminæ, soluble to a reddish-violet solution in water. On adding ammonia, the solution is decolorised and the carbinol base separates as a greenish flocculent precipitate. In a similar manner, *o*-chlorodiethyl-*p*-amidobenzaldehyde condensed with *m*-chloro-diethylaniline and oxidised, gives a product dissolving to a greenish-blue solution and dyeing silk, wool, and mordanted cotton pure greenish-blue shades.
—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Hat Bodies, Working up the Raw Material into. Oesterr. Hutmacher Zeit. **16**, [4], 3 ; [5], 3.

The wool, after careful sorting, washing at about 125° F. (with a weak solution of ammonia soda, common salt, and stale urine), and rinsing, is dried at a moderate temperature and mixed with up to 50—60 per cent. of combings: the following proportions being suitable for soft hats: (I.) Medium fine lambswool, 20 per cent.; Cape scoured, 20; medium fine Cape combings, 60 per cent. (II.) Snow-white Cape, 20; Australian piece wool, 20; loose Hungarian, 20; medium fine Australian combings, 40 per cent. (III.) Cape scoured, 40; Australian combings, 60 per cent.

For lower qualities and medium to dark colours: Cape wool, 20; Hungarian fleece, 15; Cape combings, 15, and Thibet, 50 per cent. may be taken.

Finer goods are made almost exclusively from lambswool, Australian combings, or best fleeces, and are milled with soap only. After careful mixing by hand and passing through an opener the wool is spread out in layers (16—20 inches deep), which are then sprinkled with a softening mixture of 4 per cent. of oil, $\frac{1}{4}$ per cent. of soda, and 20 per cent. of water. Ammonia is an undesirable constituent, being injurious to the carding pins, and oleine is only advisable when perfectly free from mineral acid.

In carding, the card furniture must be selected in accordance with the fineness of the material to be treated, and should not be set so close as to uselessly wear away the pins.—C. S.

Carbonising Wool Hat Bodies with Sulphuric Acid, &c. Deutsche Hutmach. Zeit. **30**, [20].

The best stage of the manufacturing process at which to perform this operation is when the felt has been partly fulled, since the burrs and other impurities are then got rid of in the subsequent fulling and washing; whereas, although loose wool is easily carbonised, the felting power is decreased and the product is always spongy after fulling. On the other hand if carbonising be performed between the operations of steaming and dyeing, the hat bodies are more liable to spot, and become pitted by the falling out of the burrs.

The acid bath for carbonising is sulphuric acid of 3°—4° B. for white hats, or aluminium chloride of 6°—8° B. for coloured hats, and the time of immersion 1—$1\frac{1}{2}$ hours, the wool being less attacked than by longer exposure to weaker acid. After careful draining in a hydro-extractor, the goods are dried in a hot chamber at 40°—50° C., the temperature being afterwards increased to 70—80° C. to burn out the impurities. They are then neutralised by immersion and working for $\frac{1}{4}$—$\frac{1}{2}$ an hour in a warm solution of "soda" of sp. gr. $1\frac{1}{2}$—2 B. Thorough rinsing is necessary, or a deposit of alkali salts will remain on the wool and make it harsh to the touch. If only half fulled, the goods are finished in the fulling mill before neutralising. Hats carbonised after steaming should be well washed for half an hour in plenty of warm water to remove the greater part of the acid, an excess being undesirable in dyeing, though a little will do no harm when aniline and alizarin dyestuffs are used.—C. S.

Hat Bodies: Fulling with Sulphuric Acid. Deutsche Hutmacher Zeit. **30**, [22].

Though the use of sulphuric acid for this purpose is attended with the drawback that the machinery is liable to corrosion, this is more than counterbalanced by the advantages offered by this method, which enables a poorer class of raw material to be worked up into a more solid and closer felt than by fulling with soap. The hat bodies may be carbonised either after the preliminary treatment with dilute acetic acid, or after fulling is completed. When the material has become nearly equal to the sample to be matched, the acid is drained off and the bodies rinsed with slightly warm water, then neutralised with sodium carbonate and ammonia. After leaving at rest for an hour, more sodium carbonate is added until the material ceases to give an acid reaction to test paper, and the bodies are washed with soap, sodium carbonate, and ammonia, to remove all dirt and grease.

It is inadvisable to perform the fulling operation too quickly. Ladies' hats and cheap hats for children do not require to be fulled to the same extent as men's hats, and a few hours will therefore be sufficient, whilst for the latter kinds, 8, 10, and 12 hours are necessary. Thorough cleansing after fulling is essential to the production of a strong and smooth felt. A useful indication is afforded by the absence of smell in the washed bodies, and by the effect produced on pouncing-paper, which will reveal any trace of grease left in the bodies.—C. S.

Crêpon Effects on Wool, A Process for Obtaining. E. Siefert. With Report on the same by C. Schoen and E. Grandmougin. Bull. Soc. Ind. Mulhouse, 1899, 86—92

Many processes have been devised for producing on wool similar effects to those obtained on cotton by treatment with caustic soda, but none have been successfully applied in practice. Many substances are capable of contracting woollen fabrics with the aid of a subsequent steaming, *e.g.*, bisulphites, the chlorides of tin ($SnCl_2$), zinc, and calcium, citric and tartaric acids, resorcinol, &c., but with all of these there is great danger of tendering the fabric during steaming.

The sulphocyanides have the power of contracting wool without injuring the fibre. By printing with sulphocyanides and then steaming for 3—5 minutes, crêpon effects are produced with a contraction in the printed portions of 15—20 per cent. These portions show an increased affinity for acid dyestuffs, but a decreased attraction for basic colouring matters. It is necessary to avoid the least stretching of the material during steaming, since any resistance to the contraction prevents it from taking place; and even if the fabric be *hung* in the steam chamber, contraction occurs only in the lower portion, and not in the upper part of the fabric, where the tension is greater.

Report.—The authors have fully confirmed the observations of M. Siefert, and have obtained favourable results by printing with a mixture of 1,500 grms. of calcium sulphocyanide and 1 litre of thickening, and steaming for five minutes without pressure. Instead of calcium sulphocyanide the barium salt may be employed, but the ammonium salt does not produce the same effect. The process has no injurious action on the wool fibre. The effect may be obtained without steaming, but is complete only after several days, and is less marked than when the fabric is steamed.

The substances which contract woollen fabrics at a high temperature appear to be either dehydrating agents, *e.g.*, $ZnCl_2$, $CaCl_2$, or reducing agents, *e.g.*, $SnCl_2$, and bisulphites.

Another process which has been proposed is to print with an acid, then pass through bleaching-powder solution and mill the fabric, when the unprinted portions only are contracted, since chlorinated wool has lost the power of felting. This process has not yet been successfully worked on a commercial scale.—R. B. B.

Crépon Effects on Woollen Fabrics, The Production of. E. Jaquet. Bull. Soc. Ind. Mulhouse, 1899, 95.

A sealed note, dated June 1895, describes the employment of alkali sulphites or bisulphites for the purpose of obtaining contraction and crinkled effects on woollen fabrics. After the application of these substances, the goods are steamed for about half an hour.—R. B. B.

Oxycellulose, Osazones of. L. Vignon. Comptes Rend. 1899, **128**, [17], 1038—1040.

The author prepared oxycellulose from pure cotton by various methods, and treated the products with a solution of phenylhydrazine and acetic acid under the ordinary conditions for the preparation of osazones, heating for 30 minutes at 80° C. The oxycellulose preparations fixed more phenylhydrazine the greater the degree of oxidation. Of the methods of preparation, those by means of acid oxidants are far better than those by means of alkaline agents, because of the destruction of the products by caustic alkalis. The proportions of furfural obtained from the oxycelluloses varied in the same direction as those of phenylhydrazine fixed, but the relations between the two properties were not constant. The results are summed up in the following table:—

Method of Preparation.	Yield per 100 Cellulose.	Nitrogen fixed.	Corresponding to Phenyl hydrazine fixed.	Furfural.
		Per Cent.	Per Cent.	Per Cent.
Bleached cotton	..	0·448	1·727	1·60
Oxycellulose by chlorate and hydrochloric acid	73·2	2·06	7·94	2·09
Oxycellulose by alkaline sodium hypochlorite (boiling)............	16·5	0·87	3·37	1·79
Oxycellulose by chromic and sulphuric acids:—				
(1.) 48 hours in the cold.	85·0	1·82	7·03	3·00
(2.) 120 hours in the cold.	50·0	2·00	7·71	3·09
(3.) One hour boiling	45·0	2·20	8·48	3·50

—J. F. B.

PATENTS.

Filaments for Textile Purposes, Impts. in Producing. A. Millar, Glasgow. Eng. Pat. 6700, March 19, 1898.

Filaments for textile purposes are produced from albumin from eggs or blood, the gelatinous substance obtained from seaweed or other similar material, in the following manner. The substance is treated with salts, such as phosphate of lime or alumina, or alkaline earths, and then, after rendering plastic by heat or other means, is placed in a cylinder which communicates by a stop-cock with a smaller cylinder provided with a number of fine jets or nozzles. By keeping an even pressure on the first cylinder, say 5 lb. per sq. in., the substance is forced out of the jets, and is taken up on endless bands of considerable length, so that the threads become dry before being taken off by the bobbins.

The albuminous substance is treated, either before or after formation into threads, with a solution containing 0·4 per cent. of formaline.

Any other salts capable of rendering gelatin insoluble may be incorporated with the substance. (See also this Journal, 1898, 240.)—C. M.

Wool and other Animal Fibre, Impts. in the Treatment of the Wash Liquors from, to Recover the Grease and Potash therefrom. J. Smith and Sons, Ltd., and W. Leach, Bradford. Eng. Pat. 15,131, July 9, 1898.

See under XII., *page* 592.

Dressing for Use in Preparing Cloths or Canvas for Making Waterproof Covers of all kinds, such as Tarpaulins, Van Covers or Sheets, Railway Sheets, Drivers' Aprons, Horse Loin Cloths, and other Articles; Impts. in the Preparation of. T. P. Coubro, London. Eng. Pat. 22,187, Oct. 21, 1898.

This is a modification of Eng. Pats. 16,593, 1892, and 24,920, 1897 (this Journal, 1898, 919). A paste is made up by incorporating ground slate, fuller's earth, or any suitable pigment with a mineral oil, sp. gr. 0·880—0·920 and flash-point, 260° C. This is applied to the canvas, which will then take the "patent dressings" ordinarily employed. Or, the tar or patent dressing, mineral oil, and pigment may all be mixed together so as to form one composition.—F. H. L.

Composition [Acid-Proof and Impermeable], Improved, for Dressing of Fabrics of all kinds employed in connection with Chemical, Alimentary, and other Products. J. B. A. Grouchy, Paris. Eng. Pat. 23,440, Nov. 7, 1898.

Gelatin, dextrin, potassium bicarbonate, acetic acid, glycerin, Marseilles soap, "sulphate of lanthanium," kaolin, and barium sulphate, are mixed together as specified with water, and used to steep sacks, &c., in.—F. H. L.

Treating Cotton to give it the Glossy Appearance of Silk, A New Method of. F. Gros and P. Bourcart, Remiremont, Vosges. Eng. Pat. 25,881, Dec. 7, 1898.

A process for mercerising cotton by the usual methods, but at the stage when it is in the rove or sliver condition.

After mercerising, it is washed in the usual way, dried, and then untwisted and reduced to the state of spinning material. In this way it is claimed that it is possible to obtain single mercerised threads, which hitherto have not been obtained. (See also this Journal, 1898, 149, 240, 345, 452, 573, 756, 840, and 1140; 1899, 36, 136, 267, 366.)

—C. M.

Artificial Silk Thread, and Apparatus therefor; Impts. in the Manufacture of. R. W. Strehlenert, Stockholm. Eng. Pat. 58, Jan. 2, 1899.

This invention is an improvement on Eng. Pat. 3832, 1897 (this Journal, 1897, 533). The silk solution issues from a cylinder with a perforated bottom (the mouth-piece), and the threads are collected in a funnel containing a continuous supply of water for dissolving the solvent of the silk. The threads all unite at the neck of the funnel, and by rotation of the mouth-piece are twisted and taken through a knee-bent tube on to a bobbin.

Another improvement consists in having the mouth-piece stationary and causing the water in the funnel to rotate by suitably arranging the inflow tube. In this case a broken thread is caught up by an unbroken one before reaching the neck.—C. M.

Silk, Silk Waste, Wool, and like Materials and Fabrics, for the Purpose of Eradicating Hairs and similar Foreign Substances; New or Improved Solution for Treating. F. Hilton, Macclesfield. Eng. Pat. 2294, Feb. 1, 1899.

This process is particularly applicable to the waste product known as "wild waste," but may be used for other silk waste.

A mixture is made of two parts of hydrogen peroxide (10 to 20 vols.) and one part of sodium silicate solution (three parts silicate to one part of water). For every 100 lb. of "wild waste," 4 galls. of the above mixture are used, and the whole is boiled with a convenient quantity of water for about one hour. The result is that the substance is bleached, and all animal hairs and other foreign matters are dissolved. For silk, woollen, and like materials, treated preferably before being manufactured, a solution is made of 4 galls. of the mixture to 100 galls. of water, and the material is digested in it for about six hours.—C. M.

Manufacturing Corrugated Roofing or Non-Conducting Plates from Felt, Canvas, and similar Fabric or Material; New or Improved Method of. P. Knoch, Berlin. Eng. Pat. 3745, Feb. 20, 1899.

Convenient breadths of felt or of layers of jute cloth, sack-cloth, &c., are steeped in chrome-gelatin until saturated. They are then, when about half dry, pressed between hot plates, which give them a corrugated form, or between suitable hot rollers for the same purpose. After this operation, the material, which retains the form given to it, is treated with aluminium acetate, and subsequently coated with asphalt or similar material outside, and with oil paint inside.

In this way it is claimed that a light roofing, unacted on by acid fumes, is produced, suitable for railway stations, carriages, locomotive sheds, &c.—C. M.

Utilising Waste Loom-heddles and similar Filamentary Material of Vegetable Origin, Process or Processes for. B. Themans, Enochede, Holland. Eng. Pat. 9624, April 26, 1899.

Waste heddles are boiled with an equal weight of caustic soda ($2\frac{1}{2}^{\circ}$ to 3 B.) for several hours. They are then rinsed with water and dried in a centrifugal machine. After bleaching with chloride of lime ($\frac{1}{2}^{\circ}$ to 1° B.), washing with hydrochloric or sulphuric acid (1° to 2° B), and thoroughly rinsing, the material is subsequently boiled with caustic soda solution (2 to 5 per cent.), rinsed, and dried in a centrifugal machine. The substance can now be used for cotton wool.

The oil is recovered as a varnish by acidifying the first caustic liquor, collecting the varnish which separates, thoroughly washing it, and boiling with alcohol to remove any china clay or other insoluble body. Finally, the alcohol is wholly or partially distilled off.—C. M.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Superheated Steam, The Application of, for Dyeing Purposes. W. Fehrmann. Färber-Zeit. 1899, **10**, 81—83 and 100—102.

Great difficulties are often experienced in the management of boilers for supplying steam to a dye-house, owing to the irregular consumption of steam. Much more steam is usually required in the morning than in the afternoon, and whilst in the early part of the day it is difficult to maintain the pressure in the boiler, later on the pressure tends to rise too high. When there is an excessive demand for steam, the consumption of feed water increases in greater proportion than the consumption of fuel, but the whole of the water is not converted into steam, a large amount being mechanically projected into the pipes with the steam, and under these conditions, water has been found in the steam in the proportion of 50 per cent. of the weight of the latter. The presence of this water in the steam used for heating dye-vessels is very objectionable; not only does it dilute the dye liquor, but it often prevents the raising of the temperature to the boiling point.

The remedy for this state of things is, in the author's opinion, the employment of superheated steam. In his dyeworks the same number of boilers is in use all day long, but with the difference that in the morning the temperature of the steam at 4 atmospheres pressure is 145° C., *i.e.*, the temperature of saturated steam at this pressure, and in the afternoon the temperature rises to about 280° C. No disadvantages have resulted from the use of steam at this high temperature, a saving of about 18 per cent. of fuel has been effected, and the complete absence of water in the steam has been found to be an advantage from every point of view. For superheating the steam, the author has devised a special form of apparatus suitable for use under the conditions which usually obtain in a dyeworks.

—R. B. B.

Tussah Silk; The Boiling-off, Bleaching, and Dyeing of. C. Heinrich. Färber-Zeit. 1899, **10**, 86.

The silk-gum and the natural colouring matter of Tussah silk are far more resistant than those of cultivated silk, and it is necessary to employ strongly alkaline solutions for boiling-off. After a preliminary cleansing in a 1 per cent. solution of sodium carbonate, the silk is boiled with 10—12 per cent. of soft soap, allowed to cool in the liquor, and the bath again heated to the boil. For white or pale colours, the silk must be bleached, and this is preferably done by means of hydrogen peroxide; after bleaching, the goods are tinted ("blued") in a strong soap bath with Methyl Violet and Rhodamine.

Tussah silk is dyed with acid or basic dyestuffs in a "broken" boiled-off liquor bath, the temperature of the bath being raised to the boiling point two or three times. After dyeing, the silk is brightened in comparatively strongly acid baths and lustred by stretching and steaming.

—R. B. B.

Tannin Resists for Azo Colours (Paranitraniline Red and Naphthylamine Crimson). J. Kœchlin. Bull. Soc. Ind. Mulhouse, 1899, 74—75.

According to the author's process, described in a sealed note dated March 1895, a thickened solution of tannin printed on cotton serves as a resist for Paranitraniline Red or Naphthylamine Crimson produced in the usual manner. For yellow, blue, or green resists, basic colouring matters are added to the tannin, and for black, a steam logwood black. After printing, the goods are steamed for two hours before padding with β-naphthol.—R. B. B.

Tannin Resist for Paranitraniline Red. J. Langer. Bull. Soc. Ind. Mulhouse, 1899, 76—77.

The author states, in a sealed note dated September 1894, that tannin gives insoluble precipitates with diazo compounds. For a white resist he therefore prints on a fabric prepared with β-naphthol, a thickened strong tannin solution; the material is then passed into diazotised paranitraniline, and the tannin precipitates this substance in the printed portions before it has had time to unite with the naphthol. By adding basic dyestuffs and preferably also citric or tartaric acid to the printing mixture, coloured resists are obtained. (See also preceding abstract.)

—R. B. B.

Action of Light upon Colours, Means of Measuring the. A. Scheurer and A. Brylinski. Bull. Soc. Ind. Mulhouse, 1899, 93—94.

Further details are given regarding the colour standards chosen for comparison in estimating the action of light upon dyed colours (Bull. Soc. Ind. Mulhouse, 1898, 119; this Journal, 1898, 759). The deep Indigo Blue on cotton corresponds to 1·2 grm. of Indigotin per sq. m. of cloth, the medium shade to 0·52 grm. and the pale shade to 0·25 grm. of Indigotin.—R. B. B.

Black Print on Red, The Production of a. E. Steiner. Bull. Soc. Ind. Mulhouse, 1899, 96—97.

A fabric which has been dyed a plain red is printed with a colour containing Turquoise Blue B B (Bayer), "dinitroresorcinol," and potassium ferrocyanide together with tannic, acetic, and tartaric acids and thickening substances. After printing, the goods are steamed for 10—20 minutes, passed through tartar emetic, washed, and soaped.

To obtain a black on a red ground, it is necessary to print with a green dyestuff, *i.e.*, one capable of absorbing the red rays, and yet it is not advisable that the red rays should be completely absorbed, since in this case the black would appear greenish by contrast with the red. Turquoise Blue fulfils this requirement more nearly than any other dyestuff, its solution showing a complete absorption of yellow and orange and a partial absorption of red. No black dyestuff should be added to the printing colour, since it would detract from the brilliancy of the shade. The "dinitroresorcinol" and iron are necessary to render the colour fast to light and soap, and tartaric acid is added to prevent the formation of tannate of iron.—R. B. B.

Silk, Photographic Prints on. Bull. Soc. Hav. Phot. 1898; through Monit. Scient. 1899, [4], **13**, 167.

Fine silk is floated on a bath composed of 900 c.c. of a filtered and cooled solution of 10 grms. of Iceland moss in 2 litres of boiling water, 40 grms. of common salt, and 100 c.c. of glacial acetic acid. After drying, it is sensitised by floating on a bath of 50 grms. of silver nitrate and 5 grms. of citric acid dissolved in 500 c.c. of water, and again dried. Prints are taken on this as on ordinary sensitised paper (the printing being carried hardly so far as with paper), are toned and fixed in the ordinary way, and are lastly ironed to restore brilliance to the silk.—J. T. D.

Azo Colours derived from the Nitranilines [Insoluble Azo Colours produced on the Fibre], The Action of Alkaline Reducing Agents on. J. Brandt. Bull. Soc. Ind. Mulhouse, 1899, 77—85.

Reducing agents of an acid character split up the molecule of an azo compound into an amido derivative and an amidophenol, or into two amido compounds; but the action of alkaline reducing agents, especially on the nitro derivatives of azo compounds, is very different, and varies according to the position of the nitro group and the conditions under which the reaction takes place.

The author has investigated the reactions which occur when cotton dyed with insoluble azo colours is printed with alkaline reducing agents. Three different reducing mixtures were employed: (*a*) glucose and caustic soda; (*b*) sodium sulphide (sulphur and caustic soda); and (*c*) stannite of soda (by successively printing with stannous chloride and caustic soda). These mixtures were printed on cotton dyed with five different azo compounds, and the results are summarised in the following table:—

——	Reduced with Glucose and Caustic Soda.	Reduced with Sodium Sulphide.	Reduced with Stannous Chloride and Caustic Soda.
Paranitraniline (Red)	The red is rapidly changed to crimson, which, on steaming, becomes a full purple-red (puce).	Changed to grey after steaming for one hour.	Dilute solutions change the shade to crimson or puce. With strong solutions and long steaming, a white discharge results.
Paranitro-orthoanisidine ("Naphthol Pink").	Pink changed to violet.......	Bright greyish-blue	Similar to Paranitraniline Red, but more readily discharged.
Metanitraniline (Orange)...............	Orange becomes brown	Brownish-grey of no value ...	Weak solutions change the shade to brown; stronger solutions discharge to dirty white.
Orthonitraniline (Orange).............	Bright grey.................	Bright grey.................	With strong solutions a white discharge, which may be made very clear by adding Na-β-naphthol to the $SnCl_2$, and long steaming.
Orthonitrophenetidine ("Blue-red" M. L. & B.).	Clear white discharge.......	Greyish-white discharge	.. ..

From these results it is evident that the ortho nitro derivatives are the most easily attacked by alkaline reducing agents; with these compounds there is immediate decomposition of the azo molecule and reduction of the nitro group, but in the case of meta- and para-derivatives, stable intermediate products are formed which cannot be destroyed by any reducing action compatible with the integrity of the fabric.

Many of the reactions here tabulated may find useful employment in printing. For instance, a fabric printed in strip of two colours with Paranitraniline Red and Orthonitraniline Orange is again printed with caustic soda and glucose in stripes at right angles to those first printed. Squares of four different colours are thus produced, the red being changed to puce and the orange to grey.—R. B. B.

PATENTS.

Printing and Discharging of Woven Piece Goods, Impts. in the. E. Ogden, Bramhall, Cheshire, and W. H. Fay, Patricroft, Lancs. Eng. Pat. 13,420, June 16, 1898.

The yarns for the warps or wefts, or both of them, are dyed with dyestuffs capable of being discharged, and are then woven into fabrics. The fabric is printed in pattern with a discharge, and may also be printed with colours if desired.—R. B. B.

Vats for Dyeing or Impregnating Fabrics, Impts. in and relating to. D. Horsburgh, Radcliffe, Lancs. Eng. Pat. 13,495, June 17, 1898.

In connection with the dye-vat two rollers or pairs of rollers are so mounted that by means of a lever handle either of them may be brought above the surface whilst the other is immersed in the liquor. The cloth to be dyed passes from a beam or roller (A) to the roller (B) below the surface, then upwards to squeezing rollers (C), round another roller (D), and finally to a cylinder on which it is wound. The position of the rollers B and D is then reversed by means of the lever, and the cloth may thus be passed through the vat in the reverse direction with the same sequence of operations as in the first passage.
—R. B. B.

Paper, Woven Fabrics, and the like; Improved Process of and Apparatus for Producing Designs upon, by means of Template Printing. W. F. Toifel, Vienna, Austria. Eng. Pat. 13,725, June 20, 1898.

The material to be printed and the template, are caused to move uniformly and at the same speed between a printing roller and a counter roller or table. The template is in the form of an endless band passing over rollers, and the colour is supplied by another endless band, which is kept wet with it. This latter band passes between the printing roller and the template, so that the pressure of the printing roller on its counter roller or table squeezes the colour from the endless band through the template and on to the material.
—R. B. B.

Textile Fabrics having Two-coloured and Crape Effects, Impts. in the Manufacture of. S. Pitt, Sutton. From L. Cassella and Co., Frankfort-on-Main. Eng. Pat. 14,472, June 30, 1898.

This process consists of weaving together "chlored" and "unchlored" wool. On dyeing with acid or diamine dyestuffs, the chlored wool takes up much more colour than the unchlored wool. Crape or crimping effects are also produced, and the result is intensified by using as the "chlored" wool that of hard quality. Cotton or silk threads may also be interwoven. If the goods are to be milled, it is advisable to use acid milling baths.—C. M.

Colouring of Textile Fabrics and Yarns, and Apparatus therefor; Impts. relating to the. J. W. Fries, Salem, Forsyth, North Carolina, U.S.A. Eng. Pat. 4994, March 7, 1899.

This process consists of preparing a dye-bath, with suitable colour, of a syrupy consistence, by thickening with starch and caustic soda. The web of textile material is then led by guide rollers through the bath and then between pressure rollers, which expel the air and force the colour through the fabric. This operation is repeated if necessary. The fabric is then passed over drying cylinders until thoroughly dry, when it is calendered and finished.—C. M.

VII.—ACIDS, ALKALIS, AND SALTS.

Nitrogen Tetroxide, Behaviour of, with Sulphuric Acid and Nitric Acid. Lunge and Weintraub. Zeits. für angew. Chem. 1899, 417—424.

As the result of their investigations the authors arrive at the following conclusions:—

(1.) The reaction between sulphuric acid and nitrogen tetroxide is a reversible one, since the resulting nitric acid acts upon nitrosyl sulphuric acid so as to produce sulphuric acid and nitrogen tetroxide. There thus results in this reaction a solution in which the four bodies, sulphuric acid, nitrogen tetroxide, nitrosyl sulphuric acid, and nitric acid, are present in equilibrium.

(2.) At a concentration of 66° B. for the sulphuric acid, the conversion of the nitrogen tetroxide to nitric acid and nitrosyl sulphuric acid is the main reaction; the reverse reaction only comes into consideration when the quantity of sulphuric acid is very small compared with that of the nitric acid.

(3.) The affinity of sulphuric acid for nitrogen tetroxide decreases very rapidly with increasing water content, so that with sulphuric acid of sp. gr. 1·65, the action of nitric acid on the nitrosyl sulphuric acid becomes the most important. Any added nitrogen tetroxide remains therefore for the greater part free, although the quantity of nitric acid first formed by the reaction is small.

(4.) In the sulphuric acid manufacture, the quantity of sulphuric acid is so great compared with that of the nitric acid, that practically all the nitrogen tetroxide is present as nitrosyl sulphuric acid and nitric acid; this confirms Lunge's earlier conclusions.

(5.) The same conclusion applies to the analytical determination of the nitrous gases by absorption in concentrated sulphuric acid, since, in this case, the quantity of sulphuric acid is always in considerable excess.—J. T. C.

Potassium Ferrocyanide, Action of Carbon Monoxide on Solutions of. J. A. Muller. Bull. Soc. Chim. 1899, **21**, [3], 472—475.

The author finds that for the preparation of potassium carbonyl ferrocyanide, it is necessary that both water and free carbon monoxide be present. Also the amount of carbonyl ferrocyanide formed from a given quantity of ferrocyanide solution (this Journal, 1898, 700), increases with the proportion of carbon monoxide employed, but the conversion is never complete. This limitation is due, not to the inverse reaction, but to the fact that the carbonyl ferrocyanide is decomposed on heating with water, carbon monoxide being evolved. The change may be represented by the following equation:—

$$4K_3FeCy_5CO + 4H_2O = 3K_4FeCy_6 + 4CO + (HCOO)_2Fe + 2NH_3.$$

—T. H. P.

Electrolytic Alkali Works (Hulin's Process) at Clavaux, France. J. B. C. Kershaw. Eng. and Mining J. 1899, **67**, [17], 497. (See also this Journal, 1895, 968.)

In the Hulin process a fused mixture of lead chloride and sodium chloride is electrolysed by the aid of a carbon anode and a molten lead cathode, in specially designed crucibles, each crucible requiring an E.M.F. of 7 volts when working with a current density of 700, ampères per square foot. The chlorine is liberated as a gas at the anode, whilst the sodium unites with the molten lead to form a sodium-lead alloy, from which it may be subsequently recovered, in the form of sodium hydrate, by treatment with water. The presence of lead chloride in the electrolyte is necessary in order to ensure the regular working of the process. Vautin found, when electrolysing fused sodium chloride alone, that the surface of the lead cathode speedily became crusted with the lighter sodium alloy, and that a high E.M.F. and loss of sodium resulted from this tendency. In the present process, however, the lead chloride undergoes electrolysis concurrently with the sodium chloride, and under these circumstances a regular and constant diffusion of the sodium-lead alloy into the molten lead takes place. In order to provide for a renewal of the lead chloride in the electrolyte, a secondary lead anode is made use of in addition to the carbon anode. A definite proportion—12 per cent. has been found to be sufficient—of the total current is passed through the lead anode, the chlorine set free at its surface forming lead chloride, which diffuses into the molten mixture.

In the following tables, the author compares the Hulin process with two of the wet electrolytic processes, the figures used being based on the results of experimental trials:—

TABLE I.

Current and Energy Efficiencies.

Process.		E.M.F. required. Volts.	Actual Yield in Grams. Per Ampère Hour. NaOH.	Per Ampère Hour. Cl.	Per K.W. Hour. NaOH.	Per K.W. Hour. Cl.	Efficiency per Cent. Current.	Efficiency per Cent. Energy.
Wet	Hargreaves-Bird	3·4	1·196	1·057	351	310	80·0	54·0
	Castner-Kellner	4·0	1·363	1·136	340	284	91·0	52·3
	Theoretical figures	2·3	1·495	1·322	650	574	100·0	100·0
Dry	Hulin	7·0	1·052	0·907	156	129	69·3	41·5
	Theoretical figures	4·2	1·495	1·322	356	314	100·0	100·0

TABLE II.

Electrical Energy required to Produce 1 Ton of 70 per Cent. Caustic Soda and 21 Tons of 35 per Cent. Bleach.

Process.	Type.	K.W. Hours.	Cost.*
			Dols.
Hargreaves-Bird	Wet	2·609	10.00
Castner-Kellner	Wet	2·694	10.36
Hulin	Dry	6·105	16.65

* The cost of the Hulin process is calculated on the use of water-power, that of the others of steam-power.

The Hulin process is thus less efficient, both as regard energy and current, than the wet processes; but, on the othe hand, it possesses the following advantages:—

(1.) A high current density can be safely used with fused electrolytes, and thus a comparatively large production can be obtained from a small decomposing plant. The output for a given cathode area is 30 times greater by the dry process than by the wet ones.

(2.) By-products of considerable commercial value (spongy lead and lead peroxide) are obtained on lixiviating the sodium-lead alloy.

(3.) Solutions of caustic soda of high strength, and perfectly free from sodium chloride, can be obtained by simple lixiviation of the sodium-lead alloy, without any evaporation. The Castner-Kellner process also possesses this advantage.—A. S.

Alkali Chlorides, Electrodes for the Electrolysis of. H. Becker. Ind. Electrochim. 1898, **2**, 25—26.

The author reviews the materials proposed and patented as electrodes for the electrolysis of solutions of alkali chlorides. The materials in general use are gas carbon, or a moulding compound formed from a mixture of graphite with ordinary coke. The use of rough blocks of gas carbon made into one conducting medium, in various ways, has been patented by many inventors, whilst others have proposed a mixture of powdered carbon and tar moulded under pressure and heated to 1,000° C. Peroxide of lead has been suggested by Gerald and Falconer, and magnetite or ilmenite by Blackman. Although neither platinum alone nor platinised electrodes are satisfactory, electrodes formed of an alloy of platinum and iridium are in actual use in several works. Kellner has patented a form of electrode in which short platinum wires are embedded in an ebonite plate. The use of ferro-silicium has been patented by Hoepfner, and chromium phosphide has been suggested by Parker and Robinson. Gas carbon, iron, and nickel are the materials in general use as cathodes; but the use of copper oxide has been patented by Richardson and Holland, and Franchot and Gibbs; mercury by Castner and Kellner; and molten lead by Vautin and Hulin.—A. S.

Sodium Pertungstate by the Electric Current, Preparation of. G. E. Thomas. J. Amer. Chem. Soc. 1899, **21**, [4], 373—381.

Scheelite from Bohemia and wolframite from Connecticut were separately digested in a finely divided state for several days with aqua regia. After washing, the insoluble residue was treated with ammonia solution. The product was evaporated and the crystals ignited and subjected to the action of hydrochloric acid gas to remove any molybdenum. After re-ignition of the oxides, they were again treated with ammonia and repeatedly crystallised. Reduction of the oxides from these salts with hydrogen gas showed that the products from both sources were identical; the tungsten from the wolframite had an atomic mass of 183·64 and that from the scheelite 183·76. Attempts to prepare sodium tungstate of sufficient purity for this purpose by fusion of wolframite with sodium carbonate failed, because it was impossible to get rid of the last traces of silica and carbonate. The ammonium tungstates were therefore prepared in the above way and decomposed with pure caustic soda. The tungstate was then purified by electrical decomposition from all the free alkali, and finally obtained quite pure.

When sodium tungstate, dissolved in water and acidified with acetic acid, was electrolysed in a bulb containing the anode, with an opening at the bottom covered by parchment, and the whole immersed in acidulated water, a solution was obtained which contained sodium pertungstate, The solution was evaporated to a syrup and crystals separated; these, however, only contained 0·4 per cent. of active oxygen, and pure pertungstate could not be isolated from them. Its formation was proved, however, by the liberation of ozone from the crystals and solution, on treatment with acids.—J. F. B.

Nitrogen Peroxide, The Action of Nitric Oxide on. Harold B. Dixon and J. D. Peterkin. Proc. Chem. Soc. **15**, [209], 115—116.

Some few years ago, the question was keenly debated whether nitrogen trioxide existed in the gaseous state. On both sides, the final appeal was made to the behaviour of nitric oxide when mixed with gaseous nitrogen peroxide. Ramsay and Cundall (Trans., Chem. Soc. 1895, **67**, 672) broke an inner tube, containing nitric oxide over mercury, by pressing it against an outer tube containing the peroxide over mercury. No contraction was observed. The experiment proved that no considerable quantity of trioxide could have been formed on mixing the gases. Lunge and Porschnew (Zeit. anorg. Chem., 1894, **7**, 209) broke a thin glass diaphragm between a vessel containing nitric oxide and a similar one containing the peroxide. The gases showed a very slight expansion on diffusing "instead of the large contraction expected." The natural conclusion of chemists has been that apparently "gaseous N_2O_3 does not exist."

But the dissociation which nitrogen peroxide undergoes on diminution of pressure would have caused an appreciable expansion in these experiments if the nitric oxide had merely played the part of an inert gas.

The authors confirm Lunge and Porschnew's conclusion that a very slight alteration of volume occurs on mixing nitric oxide with the peroxide at 27° C., but they show that a considerable expansion occurs when the peroxide mixes with nitrogen and other inert gas. The authors infer from their experiments that at 27°, nitric oxide and peroxide combine to a limited extent to form an unstable compound, which is largely dissociated at this temperature, and undergoes increasing dissociation as the temperature is raised. The reversibility of the equation $N_2O_3 = NO + NO_2$ affords an easy explanation of the behaviour of the mixed gases towards reagents.

Acids of the Oxalic Series, The Solubility in Water of the Normal. F. Lamouroux. Comptes Rend. **128**, [16], 998.

See under XXIV., *page* 615.

Hydrocyanic Acid, Note on the Determination of, by Liebig's Method. Lextreit. J. Pharm. Chim. 1899, **9**, [7], 323.

See under XXIII., *page* 613

Boric Acid, Tests for. V. Lenher and J. S. C. Wells. J. Amer. Chem. Soc. 1899, **21**, [5], 417.

See under XXIII., *page* 608.

Acetic Acid, Separation and Estimation of, in Commercial Acetates. K. R. Haberland. Zeits. anal. Chem. 1899, **38**, [4], 217.

See under XXIII., *page* 613.

Commercial Borax, Uses of Resazurine in Analysis of. A. Lemoine. Bull. Assoc. Belge des Chim, **13**, [4], 185.

See under XXIII., *page* 610.

Ferrocyanides and Carbonylferrocyanides, The Estimation of, and their Separation. J. A. Muller. Bull. Soc. Chim. 1899, **21**, [3], 475.

See under XXIII., *page* 613.

PATENTS.

Caustic Alkalis, Impts. in and Connected with the Manufacture of, by means of Alkaline Aluminates. D. A. Peniakoff, Selzaete, Belgium. Eng. Pat. 9003, April 18, 1898.

The aluminates of alkaline earths, obtained as described in Eng. Pat. 10,252, 1896 (this Journal, 1897, 536), or otherwise, are treated with concentrated solutions of suitable alkali salts, of which the following salts are claimed: Carbonates, bicarbonates, sulphates and bisulphates of potassium and sodium, and ammonium chloride. When the latter is used, alumina, ammonia, and chlorides of the alkaline earths are obtained. The alkaline earth aluminates, when treated with alkali carbonates and bicarbonates, give a precipitate of the alkaline earth carbonate, while alkali aluminates remain in the solution. The reactions are similar when sulphates and bisulphates are used, an alkaline earth sulphate being precipitated. With respect to aluminate of calcium, this, treated at boiling point under pressure with sodium sulphate solution, gives a satisfactory yield.—E. S.

Carbonating Liquids, Impts. in Apparatus for. O. W Ackerman, New York, U.S.A. Eng. Pat. 10,038, May 2, 1898.

The apparatus comprises a cylinder for receiving the liquid to be carbonated, and also for receiving carbonic acid gas from a retort or from a store cylinder containing the gas compressed to a liquid; a second cylinder for reception of the carbonated liquid, connected by a branch of the gas pipe supplying the first cylinder, and having a pressure regulating valve; and "a porous percolator detachably mounted on the cylinder for reception of the carbonated liquid, and connected with a drop pipe in the liquid-receiving cylinder through which the gas in said cylinder forces the liquid into the percolator, into the lower part of which the gas admitted through the branch pipe enters." This vessel is practically a filter, containing an inverted porous earthenware cup within a bell-shaped case, the hollow of the cup being connected to the gas supply, and the liquid percolating into the cup meets the gas in a much divided state. The fully carbonated liquid is led to a cooling coil in a suitable box, and thence to a tap.—E. S.

Liquefied Gases, especially Carbonic Acid, Tank Waggon for. Ig. Qurin, Cologne. Eng. Pat. 12,501, June 3, 1898.

When the steel bottles in which liquefied gases are carried in waggons, are being drawn off, so much cold is developed as to cause freezing of the liquid, making it necessary to heat the necks and heads of the bottles. The present invention is intended to facilitate the conveyance and drawing off of the liquid, and consists, in part, in arranging a number of the bottles united in one or more batteries, so that the heads lie lower than the bottom ends, each battery of bottles being inclined downwards as seen from the back in the longitudinal direction of the waggon. Heaters are placed under the higher part of the battery, and also in a "special chamber," accessible from the outside, where all the heads of the bottles lie together with the bottling apparatus; so that both the higher and lower ends of the bottles can be heated. The conically-formed bottle heads with their stoppers fit into beds of corresponding shape in the side of the "special chamber," and are kept pressed from behind by draw rods resting with their lower ends in cross sleepers behind the rows of bottles lying above each other. A bent tube connected with a tube running in a horizontal direction past all the bottles, is attached to the mouth piece of each bottle, there being as many cross pipes as there are horizontal rows of bottles. These cross pipes terminate in valves joined to upright tubes which form at each side of the waggon a kind of trestle attached to the bottom of the waggon by a foot flange. The arrangement is such that the bottles may drain off completely after being emptied and cleansed by introduction of steam or otherwise. —E. S.

Mineral Phosphates, An Impt. in the Treatment of. Electric Reduction Company, Limited, London. From W. T. Gibbs, Quebec. Eng. Pat. 13,134, June 11, 1898.

See under XV., *page* 594.

Ammonia and Ammonium Chloride and certain Bye-Products, Impts. in the Manufacture of. T. Cryer, Littleborough, Lancaster. Eng. Pat. 14,199, June 27, 1898.

Dolomite is dissolved in hydrochloric acid, and the solution of calcium and magnesium chlorides obtained, is heated with slaked lime, to precipitate magnesium hydrate. The solution of calcium chloride remaining, may be treated with ammonium sulphate to obtain calcium sulphate with ammonium chloride in solution. The magnesium hydrate precipitate is heated with ammonium sulphate solution to obtain ammonia, and a residue of magnesium sulphate.
—E. S.

Sulphur Trioxide (Sulphuric Anhydride), Impts. in the Manufacture of. O. Imray, London. From The Farbwerke vormals Meister, Lucius, and Brüning, Hoechst a/Main, Germany. Eng. Pat. 14,728, July 4, 1898.

This is an improvement on Eng. Pat. 6057, 1898 (this Journal 1898, 924) for the manufacture of sulphuric anhydride, and the claim is for "the introduction of steam into the issuing sulphur trioxide gases, so as more rapidly to transfer their heat to the gases entering the contact substance." It is stated that the introduction of this modification permits of a reduction "of the greater part of the plant to nearly one-third."—E. S.

Sulphuric Acid and Sulphuric Anhydride, Improved Means of Recovering, from Gases. T. R. Shillito, London. From The Actien Gesellschaft fur Zink-Industrie vorm. W. Grillo, and Max. Schroeder, Hamborn, Germany. Eng. Pat. 25,158, Nov. 29, 1898.

A mixed solution is formed of a platinum salt (preferably the chloride) and of another salt or salts. The solution is concentrated to obtain salt crusts, which are broken up into granular particles. This material is used for filling the cylinders through which sulphur dioxide and oxygen are passed, to obtain sulphuric anhydride. "The separation of the metallic platinum in the finest sub-division between the molecules of the salts serving as vehicles for the platinum, takes place automatically upon heating, that is, upon the starting of the contact process." Sulphates or phosphates are preferably used in the process.—E. S.

Potassium Carbonate and Sodium Carbonate Lyes, An Improved Process for Utilising. H. Glaubitz, Fraulautern-on-the-Saar, Germany. Eng. Pat. 27,265, Dec. 24, 1898.

A solution of 100 parts of potassium carbonate in from 70 to 80 parts of water is mixed with 40 parts of quicklime, and the mixture is heated with constant stirring. After the reaction takes place, the whole solidifies into a white substance, which crumbles on cooling. The product may be used for bleaching and mordanting purposes, in a solid form or as a lye. Sodium carbonate lyes may be similarly treated.
—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Porcelain, Preventing Glaze Streaks on. F. Hegeler, Keram. Rundschau. 1899, 73; Thonind. Zeit. **23**, 347.

The cause of streakiness in the glaze may exist either in the condition of the glaze itself, as regards fineness of division, or in unskilful application by the workman. Coarsely ground glaze dries very quickly on the biscuit, but as the edges of the ware and the raised portions of the design absorb the medium (water), less rapidly than the other parts do, the glaze runs down on to parts of the surface that are already dry, and thus forms a thicker layer there, which shows up deeper in colour than the rest when fired. Finely ground glaze, by obstructing the pores of the ware dries less rapidly, and thus any glaze running down becomes incorporated with the still fluid mass and distributes more evenly over the surface.

In applying the glaze, care should be taken that no portion of the surface of the ware is dipped more than once, and also that the parts first immersed should be the first to issue from the bath. Hence, flat ware ought to be held vertically whilst taken out of the liquid glaze. The workmen should also take care not to allow drops of glaze to fall from their hands on to the ware after dipping.—C. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clay Washing. F. Lehman. Eng. and Mining J. 1899, **67**, [20], 592.

After referring to the different methods, such as separating and screening, grinding, &c., which have been tried for the separation of gravel sand and other foreign substances from clay, the author states that the most economical and perfect method is the slumming process, as it requires less power, and does the work thoroughly, provided adequate machinery be employed. Since in "slumming," the different kinds of clay in a deposit are thoroughly mixed and made entirely homogeneous, it is advisable to carry out the process, even if the clay does not contain gravel. The slumming process is particularly suitable in cases where the clay has to be transported over long distances, as the slumming machine can be placed in the clay hole and the slum led or forced to any place, wherever it is most convenient.

In the slumming process, the clay is fed by means of an elevator or other suitable device into a water-tight tank, in which it is brought into intimate contact with water by means of an agitator. The stones, gravel, and coarse sand sink to the bottom of the tank, and are removed, whilst the "slum," in leaving the machine, passes through a screen, in order to separate any roots and fibres present. It is then led, by means of wooden troughs in which the finer sand is deposited, into settling tanks, which are provided with filters in the bottom, and with pipes for draining off the water that gathers on top as the clay settles; if required, arrangements can be made to dry the latter in the tanks by artificial heat. A less expensive method is to run the "slum" into basins formed by throwing up banks of earth and clay, and let the water drain off through the soil, but this requires more time and ground space.

The machine requires cleaning only twice daily, and only one man is required to attend to it, and to remove all refuse. A machine with a working capacity of 50—60 tons of clay (20,000—25,000 bricks) requires 10—15 horse-power, and one man to run it; this, with the expense of transporting the clay to the machine, which varies in different establishments, represents the cost of slumming.—A. S.

Fireclay, Influence of Quartz on the Fusibility of. Thonind Zeit. **23**, [27], 345—346.

A sample of firebrick was submitted by the makers for examination, with the remark that the complaint made by a purchaser that the materials were too fusible to use in constructing a furnace dome, was apparently unjustified, seeing that the fusibility of the clay employed, equals Seger cone No. 35, whilst the quartz used is still more refractory. The results of the tests performed, showed however, that the bricks, although excellent in that they exhibited no shrinkage under the influence of repeated heatings to the fusing point of Seger cone No. 16, were fusible below cone No. 33, thus confirming the experimental results obtained by Bischof, Hecht, and others as to the lowering influence of admixtures of silica on the fusing point of clay.—C. S.

Lime Prepared at Different Temperatures, The Thermal Properties of. H. Gautier. Comptes Rend. **128**, [15], 939—941.

The author prepared four specimens of lime by heating pure calcspar: (1) at about 1,000° C. in a muffle; (2) at 1,200°—1,300° C. in an enamelling furnace; (3) in the oxy-hydrogen flame; (4) in the electric furnace, so as to fuse the lime formed. After testing the last sample to make sure that it contained no carbide or nitride, the samples were dissolved in dilute hydrochloric acid in a calorimeter, and the heats of reaction measured. The figures obtained, show clearly that no difference exists among the specimens formed at such widely differing temperatures.—J. T. D.

Slag Bricks, Manufacture of. Meyer. Thonind. Zeit. **23**, [20], 253—254.

At the Georgs-Marien Mining and Smelting Company's works at Osnabrück, the granulated slag from the blast furnaces is mixed with slag cement in the ratio of 1:8, and pressed into bricks weighing about $7\frac{3}{4}$ lb., which after 2—4 months' exposure to the air are ready for use. When not too old they are easily chiselled to any desired shape. Their rough surface facilitates setting with a minimum of mortar, and, as the latter possesses the same properties as the bricks, a close union between the two is obtained. The bricks stand a compression test of over 100 kilos. per square centimetre, and are capable of resisting the high temperature to which chimney stacks are exposed. They are also used for the setting of boilers at the manufacturers' works. Their slow rate of absorption in respect of moisture, when matured, renders them highly suitable for building purposes and as subaqueous foundations for bridges, &c.

The finely granulated slag, mixed with cement in the proportion of 11 to 1, is said to furnish an excellent concrete.
—C. S.

Cement Making, On the Magnesia Question in. O. von Blaese. Thonind. Zeit. **23**, [17], 213—216.

The results obtained from the observations made on fused magnesia cements, detailed in the paper, are considered by the author as justifying the conclusion that the presence of up to 5 per cent. of magnesia in Portland cement may be regarded as harmless. In the case of poor mortars, the magnesia content may attain 8 per cent. without danger, provided they in other respects satisfy normal requirements. It is, he considers, advisable to terminate the existing confusion relative to the permissible maximum of magnesia in Portland cement; and a sufficient margin of safety would be secured by fixing 5 per cent. as the limit, since this percentage is shown to be perfectly reliable.—C. S.

PATENTS.

Cement Kilns, Impts. in. J. Clarke, J. J. Hewitt, and T. G. Stevens, all of Greenhithe, Kent. Eng. Pat. 1612, Jan. 20, 1898.

In the construction of this kiln the whole of the space at the bottom is filled with fire bars, and there are two separate draught openings at either side of the kiln eye. The burning is said to be equalised by this arrangement. There is a further claim relating to the flues. By dividing these up into a large number narrow flue plates can be used, which are said to have the advantage of not buckling with the heat.—H. H. B. S.

Portland Cement, Impt. in the Manufacture of. J. Wetter, London. From Güldenstein and Co., Frankfort-on-Maine. Eng. Pat. 3961, Feb. 22, 1899.

The object of this invention is to utilise blast furnace slag for the manufacture of Portland cement. Equal quantities of slag, sand, and crude limestone are reduced to powder with a little "white lime," and the whole is moistened and made into bricks. These are then burnt and ground.
—H. H. B. S.

Refractory Material, Process for the Manufacture of a New. A. Imschenetzky, St. Petersburg. Eng. Pat. 4628, Feb. 24, 1898.

This is an improvement upon Eng. Pat. 5254 of 1895, for the production of artificial stone or similar refractory material, by the deposition of silica in the interstices of asbestos (this Journal, 1896, 115). In the present patent, the decomposition of the silicate is brought about by the action of an alkali bicarbonate, or by a solution of carbonic acid. Asbestos pulp is fashioned in any desired way, and then soaked in a solution of hydrated silica. The articles are then dried and saturated, first with a solution of silicate of soda, and afterwards with a solution of sodium or other alkali bicarbonate. Or the decomposition is effected by the direct action of carbonic acid under pressure.
—H. H. B. S.

Gypsum or Plaster of Paris, Impts. relating to. W. R. Johnson and G. Nichols, both of Leicester. Eng. Pat. 10,658, May 10, 1898.

This is a process for revivifying old, used, plaster of Paris, so that it can be made to set a second time. The old plaster is broken up and burnt at a moderate temperature, then partially cooled and sprinkled with dilute (about 8 per cent.) sulphuric acid. After the water has evaporated, the mass is dried and ground, and is then ready for use.
—H. H. B. S.

Lime, An Improved Process for the Dry Slaking of, and Apparatus therefor. R. Jaeger, Berlin. Eng. Pat. 3760, Feb. 20, 1899.

The apparatus consists of a drum, provided with a manhole for introducing the lime, a water tap connected by a pipe with a reservoir, and a vent-tap, which may be fitted with a safety-valve and pressure gauge. The drum is mounted upon trunnions, so that it can be rotated. The lime is placed in the drum, the manhole secured, and a definite quantity of water, equivalent to the quantity of lime to be slaked, is run in. As soon as steam begins to issue from the vent-tap, this is shut down. The pipe is then disconnected from the water-tap, and the steam-tight drum made to rotate. With very good lime it is desirable to replace some of the water by damp sand to keep the heat more under control.
—H. H. B. S

Preserving the Surface of Stone and the like, A New or Improved Method of, and Composition for Working, Cleaning, Dressing, and Polishing. C. L. Prentice, Nelson, Ohio, U.S.A. Eng. Pat. 1400, Feb. 28, 1899.

The object of this specification is to describe a process for dressing the surface of new stone, or cleaning old stone, without the employment of acids. The detergent compound consists of 6 parts of ether, 8 parts of chloroform, 2 parts of "Cologne spirits," and 16 parts of 26 per cent. ammonia; applied by means of a wire brush. When the surface has been "softened" in this manner, it is finished by polishing with a composition of two ounces of precipitated chalk and one pint of alcohol, which closes the interstices and indurates the stone.—F. H. L.

Impregnating Cellular Substances such as Wood with Fireproofing Preservative and other Reagents in Solution; Method of and Apparatus for. J. L. Ferrell, Philadelphia, U.S.A. Eng. Pat. 4431, Feb. 28, 1899.

By the present process, the wood is impregnated at a very high but even pressure, without previous exhaustion of the cells. A specially constructed cylinder is used, and the desired degree of pressure (about 500 lb. to the square inch) is initiated by heating the liquid to a temperature of about 160° F., and afterwards maintained by the operation of a pump, but between the pump and the cylinder a hydraulic accumulator is interposed, to break the pulsations of the pump. The pump delivers the liquid first into this accumulator, where the pulsations are taken up by the movements of a plunger, so that the blows of the water-hammer are prevented.—H. H. B. S.

Impregnating Wood with a Mixture or Solution to render the Wood Tenacious and Resistible to Pressure, Impts. in Apparatus and Processes for. S. Willner, London. Eng. Pat. 5043, March 7, 1899.

The object of this invention is to render wood, by impregnation, sufficiently tenacious to withstand the pressure of a die without injury to the fibre. The apparatus consists of a boiler with air-pump attachment and a furnace for heating the fluid. Within the boiler is a cradle arrangement for holding the wood, constructed so that the latter, which is at first supported above the level of the fluid, can be plunged beneath it by operating a rack and gear mechanism from the outside. The boiler is half-filled with the fluid, which is then raised to the boil. The wood is placed upon the cradle in the boiler, the manhole secured, the air exhausted and the wood let down into the liquid, where it is allowed to soak for from 5 to 10 minutes. After removal from the liquid, the wood is allowed to dry for two or three days and is then ready for stamping. The particular impregnating mixture claimed, consists of a solution of formic aldehyde and gelatin, though other fluids are suggested. The industrial application of the invention is for the production of imitation wood carving.—H. H. B. S.

X.—METALLURGY.

Metals and Alloys, Variation of Electrical Resistances of, due to Torsion. C. de Szily. Comptes Rend. **128**, [15], 927—930.

The author has determined the resistance of a wire composed of the alloy known as "Constantan" (this is an alloy of which the electric resistance can be considered as constant for small variations of temperature), 3·5 metres long, stretched by a weight, in the untwisted state, and after twisting the weight through 1, 2, &c., up to 25 revolutions. The increase of resistance is proportional to the angle of torsion, up to the limit of elasticity, 3 revolutions; beyond that, it increases much more rapidly. When the wire is allowed to remain twisted, the resistance very slowly diminishes. After being twisted and untwisted several times, the limit of elasticity is raised, for the proportionality of increase of resistance to the angle of torsion then holds much farther than for three revolutions. Apparently the variation of resistance is more rapid for thick wires than for thin ones, and a similar variation seems to occur with German silver and with "Nickeline," though the temperature variation in these alloys has as yet prevented the author from obtaining any satisfactory measurements.—J. T. D.

Gold Slimes, A Reverberatory Furnace for Smelting. W. Bettel. J. Chem. and Metall. Soc. of S. Africa, 1899, **2**, [2], 41.

The author describes a reverberatory furnace, similar in arrangement and construction to an old style of pan furnace used in smelting establishments, which it is claimed simplifies the smelting of slimes and renders the process less expensive.—J. S.

Cyanide Bullion, Alleged Shortage in. C. W. Merrill. Trans. Inst. of Min. and Met., April 19, 1899.

Contrary to the impression that the bullion returns from cyanide works are uniformly lower than the results anticipated by the assays, the author shows that at the tailings plant of the Montana Mining Co., Ltd., having a capacity of 12,000 tons per month, the actual product is more than the theoretical when calculated both from the daily assays of the charge and residue samples and from the assays of the solution before and after precipitation. In the former case the gold in the bullion was 3·02 per cent. and the silver 1·85 per cent. in excess of the estimated quantity, whilst the discrepancy resulting from the solution assays were slightly less in the case of the gold but greater in the case of the silver, the latter result, however, being partly attributable to faulty cupellation.—A. W.

Galvanic Currents, The Theory of Dissociation as Applied to. A. von Oettingen. J. Chem. and Metall. Soc. of S. Africa, 1899, **2**, [2], 21—28.

The author gives a succinct account of the modern view as to the osmotic origin of the electric current with special reference to the electro-deposition of gold and other metals from cyanide solutions.—J. S.

Silver Ores, Chemical Reactions occurring in the Amalgamation of. H. F. Collins. Trans. Inst. of Min. and Met., April 19, 1899.

After briefly discussing the various reactions explanatory of the "patio" process and describing his own experiments on the subject, the author arrives at the following conclusions:—(1) That in treating chloride ores of silver, the iron pan will give as perfect an extraction as the patio with less loss of mercury, since the affinity of iron for the chlorine is greater than that of mercury; (2) that in this pan treatment the acceleration produced by the addition of "bluestone" (copper sulphate) does not compensate for its cost, and similarly the use of the copper "fondo" in place of the iron pan is of no advantage; (3) that with sulphide ores the "bluestone" is advantageous in accelerating and increasing the extraction; (4) that the "bluestone" is rapidly reduced to metal by the iron present, the copper amalgamating with the mercury and attacking the sulphide more energetically than either iron or mercury or both together; no cuprous chloride is formed without being immediately reduced by the iron before it can exert any action on the silver sulphide; (5) that, nevertheless, cuprous chloride has a more powerful effect on silver sulphide than metallic copper, however freshly precipitated; and (6) that this powerful effect explains the fact that with raw or badly roasted ores, the extraction is better in the fondo, in which the cuprous chloride is constantly regenerated for use, than in the pan, in which, if formed at all, it is immediately decomposed.
—A. W.

Iron Silicide, A New Process for Preparing. P. Lebeau. Comptes Rend. **128**, [15], 933—936.

By heating copper silicide with iron in the electric furnace, iron silicide is formed, and is left on dissolving away the excess of copper silicide, after cooling. The substance has the formula $FeSi$, and forms brilliant metallic-looking crystals of density 6·17, which scratch quartz. It is not affected by hydrogen or oxygen at high temperatures, is attacked by chlorine or bromine at a red heat, and by fluorine at the ordinary temperature, with incandescence; is dissolved by a mixture of nitric and hydrofluoric acids, but not by other acids, and is readily attacked by fused alkalis, alkali carbonates, or nitrates. The author has prepared by a similar method, the silicides of cobalt, nickel, and chromium, and are now investigating the formation of arsenides and antimonides. —J. T. D.

Arsenic, Influence of, on the Mechanical Properties of Steel. M. J. Marchal. Rev. de Chim. Ind. 1899, **10**, [112], 110—112.

From experiments on the effect of small quantities of arsenic on the physical properties of a basic Martin steel, it is found that the capacity for welding is appreciably affected by 0·2 per cent., and that a flux of borax, sal-ammoniac, &c. is necessary when the arsenic is above this amount and up to about 2·75 per cent., when welding becomes impossible. The tensile strength increases but the elongation decreases, almost in the same ratio, with the proportion of arsenic up to a certain point, when the steel becomes brittle, the arsenic then probably converting some of the carbon into its graphitic form. The fragility increases with the arsenic, but does not reach that degree which it is supposed to by many experimenters. The malleability is not affected to any great extent. From these results it may be said that small quantities of arsenic are not prejudicial to the general metallurgical working of iron. The diversity of opinion on this point is probably due to the influence of the many other impurities in iron being aggravated by that of the arsenic, rather than that the arsenic itself produces any defect.

The specimens for these experiments were homogeneous products. They were carefully prepared by passing the weighed arsenic through a glass tube into a small mould placed in the centre of a larger one, and into which the steel was poured. The arsenic was determined by dissolving the steel in hydrochloric acid with addition of potassium chlorate, evaporating to dryness, treating with concentrated hydrochloric acid, adding double sulphate of ammonium and iron to reduce the arsenic to trichloride, distilling off the volatile chloride, condensing it in water, precipitating with sulphuretted hydrogen, dissolving the sulphide in fuming nitric acid, precipitating with magnesia mixture, igniting the precipitate, and weighing as magnesium pyroarsenate.—A. W.

Slag of the Basic Open-hearth Furnace. O. Thiel. Stahl und Eisen, 1898, 750.

In order to render the slag produced in the treatment of phosphoric pig-iron by the basic method in the open-hearth furnace, of more value for agricultural purposes, the author devised the plan of employing two furnaces, the proportion of lime or limestone added in the first furnace being kept below that required for perfect dephosphorising, with the result of producing a slag high in phosphoric acid and silica, but comparatively free from iron, and, which, in consequence of its composition, contains a high percentage of citrate-soluble phosphoric acid. The details are given of a series of charges treated by this method. The pig-iron contained 1·6—2 per cent. of phosphorus, which was reduced by the addition of 18—22 per cent. of limestone and 16—25 per cent. of ore (Swedish magnetite and pyrites residues) to between 0·25 and 0·70 per cent., while the resulting slag contained 16—22 per cent. of phosphoric acid, 16—21 per cent. of silica, and only 4·68—7·68 per cent. of iron. The steel was finished in the second furnace by the further addition of 9 per cent. of limestone; the resulting slag contained 9—11 per cent. of phosphorus, but was obtained in much smaller quantity than from the first furnace, the proportion being in the first 21·7 per cent. and in the second 8 per cent. of the weight of the metal charged. On comparing these results with those obtained by the basic Bessemer process, it was found that for equal richness in phosphoric acid, there is a larger production of slag with a smaller addition of lime in the open-hearth furnace than in the converter, this being probably due to the large loss of phosphorus by volatilisation, which in a hot blow may be as much as 30 or 40 per cent., as well as to the mechanical loss of lime carried away by the blast in the latter method. With regard to the quantity and value of the two kinds of slags, the author considers that there is an advantage of from 1*s.* 8*d.* to 3*s.* per ton of finished steel in favour of the open-hearth method; and this may be largely increased by using the more phosphoric Swedish magnetites, instead of the purer kinds, in the first furnace. Thus, with ore of 1·2 per cent. of phosphorus, it would be from 3*s.* 3*d.* to 4*s.* 7*d.*; and with 3 per cent. of phosphorus, 6*s.* to 7*s.* 3*d.* per ton of steel better than with the basic Bessemer process, without taking into consideration the extra yield due to the reduced iron.—A. S.

Brass, Weatherproof Brown Coatings for. Zeits. für Blechind. **28**, [8], 283—284.

Like other alloys rich in zinc, brass does not "brown" so well as copper, red metal, or bronze, and, for the production of "patina," should be bronzed. For artistic effect combined with durability, gold electroplating gives the best results, copper acetate and ammonium chloride, or "liver of sulphur" being afterwards used to produce durable tonings; or the depressions may be lightly shaded with black varnish, leaving bright the portions in relief.

A very handsome brown may be produced on brass castings by immersing the thoroughly cleaned and dried articles in a warm solution of 15 parts of sodium hydrate and 5 parts of cupric carbonate in 100 parts of water. The metal turns dark yellow, light brown, and finally dark brown, with a greenish shimmer, and, when the desired shade is reached, is taken out of the bath, rinsed, and dried.

Another method is to paint the cleaned and dried surface uniformly with a dilute solution of ammonium sulphide. When this coating is dry, it is rubbed over, and then painted with a dilute ammoniacal solution of arsenic sulphide, until the required depth of colour is attained. If the results are not satisfactory, the painting can be repeated after washing over with ammonia. Prolonged immersion in the second solution produces a greyish-green film, which looks well and acquires lustre when polished with a cloth.—C. S.

Aluminium, The Applications of. H. Moissan. Comptes Rend. **128**, [15], 895—901.

The author draws attention to the fact that Ditte (this Journal, 1899, 279) did not himself analyse the aluminium alloys with which he experimented, and that small amounts of impurities exercise a very important influence on the ease with which the metal corrodes. To show the progress made of late years towards the production of a pure aluminium, he quotes a number of analyses of commercial aluminium and aluminium alloys made in his laboratory in 1893 and in 1897; while the former set show percentages of iron varying from 0·32 to 1·66, averaging 1·11, and of silicon varying from 0·93 to 1·64, averaging 1·34, the corresponding figures for the latter set are, in the case of iron, 0·12, 0·32, 0·19, and in the case of silicon, 0·02, 0·13, 0·07. He points out that Ditte examined articles that had been damaged in the Madagascar campaign, but that many of them passed through the campaign and returned in good condition, and he gives quotations from officers' reports on the campaign in which the aluminium vessels are spoken of with approval. He enumerates the advantages of aluminium over tinplate, in lightness and in dispensing with soldered joints; and he mentions that aluminium cooking utensils, used for three years in his own house, and used in a large restaurant in Paris, have answered their purposes admirably and remain in perfect condition. Such purposes offer a wide field for the application of aluminium, which can be used with perfect safety.—J. T. D.

Aluminium, The Applications of. A. Ditte. Comptes Rend. **128**, [16], 971—975.

A reply to the criticisms of Moissan (see preceding abstract).

The author has experimented with pure as well as impure samples of aluminium, and recognises the great influence exerted in many ways by impurities on the rate of corrosion of the metal and its alloys. But he maintains that aluminium is in itself a readily corrodible metal, and that its preservation in use without corrosion is always due to a coating either of oxide or of fatty matters; that alkalis, the only effective cleansers for these fatty matters, readily roughen the surface of the metal and hence shorten its life; and that whilst he never meant to suggest the total disuse of aluminium for culinary and other vessels, he wished to make quite clear its disadvantages and its possible dangers. He now points out the advisability of making all such vessels as free as possible from angles, ridges, and all irregularities of surface.—J. T. D.

Gold in Ores, Simple Methods for the Detection of. J. Ohly. Eng. and Mining J. 1899, **67**, [17], 499.

See under XXIII., *page* 609.

Cyanide Poisoning. J. Loevy. Eng. and Mining J. 1899, **67**, [21], 618.

See under XXIV., *page* 616.

Mercury, Eschka's Test for, A Modification of. K. E. Chism. Berg-Hüttenm. Zeit. **58**, 149; Chem. Centr. 1899, **1**, [17], 996.

See under XXIII., *page* 609.

Mercury in Antimonious and Arsenical Sulphide Ores by means of the Gold Surface Method, Estimation of. F. Janda. Oesterr. Zeits. Berg. u. Hüttenm. 1899, **47**, 205.

See under XXIII., *page* 610.

Zinc, Determination of, in Aluminous Ores. E. Jensen. Zeits. angew. Chem. 1899 [20], 465.

See under XXIII., *page* 610.

Arsenic, Determination of, in Ores; A Modification of Pierce's Method for the. J. F. Bennett, jun. J. Amer. Chem. Soc. 1899, **21**, [5], 431.

See under XXIII., *page* 610.

PATENTS.

Ammonia, Cyanides, Coke, and Gas; Process and Apparatus for Producing. P. Naef, New York, U.S.A. Eng. Pat. 9462, April 2, 1898. (Under Internat. Convent.)

See under II., *page* 570.

Ores, Process and Apparatus for Smelting, and Recovering Valuable By-Products [Cyanides, Ammonia, &c.]. P. Naef, New York, U.S.A. Eng. Pat. 9463, April 25, 1898. (Under Internat. Convent.)

This invention relates to the production of iron and other metals in blast furnaces. Its objects are to combine the manufacture of pig-iron in blast furnaces, and the manufacture of coke and by-products.

The method consists in smelting iron ore in a blast furnace, withdrawing the hot gases therefrom at a short distance above the tuyères, utilising the same for producing coke, heating and illuminating gases and by-products and conducting the remainder of the gas through the upper part of the furnace.

The apparatus comprises a blast furnace working in conjunction with a coking and calcining apparatus and having means of continuously producing a smelting mixture of ore, coke, and lime, consisting of hoppers and conveyors for each material.—D. B.

Limestone and other Substances, Process and Apparatus [Blast Furnaces] for Calcining and Recovering Valuable By-products. P. Naef, New York, U.S.A. Eng. Pat. 9464, April 25, 1898. (Under Internat. Convent.)

The inventor claims the recovery of cyanide from hot gases containing the same, by a method which consists in taking the gases from blast furnaces at a height where little cyanide is destroyed and utilising them for calcining limestone or similar substances and treating the resulting solid and gaseous products for the recovery of cyanide. Another claim has reference to the recovery of ammonia from the hot gases by passing them through limestone in the presence of steam.

The apparatus consists of a shaft having the lowest inlets for gaseous fluids at such a height that the resistance upwards and downwards through the substance is about the same, so that the burnt substance can be withdrawn without loss of gas.—D. B.

Ores or Mineral Slimes, An Improved Method of and Means for the Automatic Concentration, Separation, and Amalgamation of Crushed. G. Fischer, London. Eng. Pat. 14,039, June 24, 1898.

The process and apparatus consists of a settling tank, or a series of the same, to which the ores, pulps, slimes, tailings, &c., with water are supplied from a flushing cistern at definite intervals through an inlet which gives to the mixture a swirling or agitating motion in the tank. The latter is provided with siphons of varying length of limb, which withdraw the mixture at different heights whilst the solid parts are settling, the different siphons thus separating and concentrating the various constituents of the ores, &c. according to their specific gravities.—A. W.

Pyrites Furnaces, Improved Means for preventing Back Draught in. C. D. Abel, London. From the Stassfurter Chemische Fabrik, Stassfurt. Eng. Pat. 14,131, June 25, 1898.

The prevention of back draught when the working doors are open for charging or stoking, is effected by connecting together the separate air supply channels of two or more systems of roasting furnaces by means of a channel, and providing the air inlets and working doors of all the furnace chambers with closing devices in such a way that with the working doors of one system open and those of the other system closed, the closing of the air supply to both systems will cause the latter system to draw its air supply, by means of the connecting channel, through the open doors of the former, thus entirely preventing the loss of any furnace gases into the open air.—A. W.

Sulphide Lead Ores, An Improved Method or Process for the Direct Smelting of, and the like. E. Ferraris, Zürich. Eng. Pat. 18,424, Aug. 27, 1898.

In the smelting of lead sulphide ores in the blast furnace, a tube, supplying compressed air in small and regulated quantities, is attached to a hole or holes built in the masonry of the lower end of the crucible containing the lead, which has been produced in the ordinary manner by smelting the ore with coal. By this means a given quantity of lead oxide is produced which then rises to the surface of the lead and decomposes the layer of sulphide thereon. The air supply is stopped when the overflowing lead is soft. The copper, if present, flows out as a rich copper matte, with the metallic lead.—A. W.

Iron and Steel, Impts. in Coating, with Copper and Copper Oxide. S. H. Thurston, Long Branch, U.S.A. Eng. Pat. 22,405, Oct. 25, 1898.

The cleaned surface of iron or steel is coated with a protecting film of copper or copper oxide by rubbing, or other impact, with metallic copper, such for instance as in the form of revolving copper brushes, the whole being then rolled or compressed. To form the oxide coating, the above is then simply heated to the temperature necessary to oxidise the film. The said product of iron or steel and copper oxide, constitutes a separate claim.—A. W.

Metals in General, Impts. in Coating, with other Metals. S. H. Thurston, Long Branch, U.S.A. Eng. Pat. 100, Jan. 3, 1899.

In this specification the claims are for the production of an amorphous, adherent, coherent, permanent film or pellicle of one metal on the clean surface of another by impinging the former on the latter, by which means the film is practically welded on to the surface. The coating of iron or steel with copper (see preceding abstract) is specified as an example.—A. W.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Zinc-Cadmium Accumulator. L'Éclair. Élect. 1898, **15**, 242—244.

A description of the Werner accumulator, in which the electrolyte is a solution of the mixed sulphates of zinc, cadmium, and magnesium. In charging, a coherent deposit of zinc and cadmium is obtained, which is practically unattacked when the circuit is open, the magnesium playing a little understood but most important part. It is found that with a concentrated solution of zinc sulphate alone, a good deposit of zinc is produced, but the peroxidation of the cathode is feeble; whilst, if cadmium sulphate be employed, a good deposit and satisfactory peroxidation are obtained, but the electro-motive force falls off rapidly during the discharge. With dilute solutions of either salt, peroxidation is satisfactory, but a poor deposit is obtained. The addition of magnesium sulphate appears to allow of the production of all the necessary conditions by means of solutions of moderate strength, but it is advisable to use more dilute solutions for rapid than for slow discharges. The accumulator has a capacity of 82 watt-hours per kilo. of plates, or 36 watt-hours per kilo. of total weight, the current being 12—15 ampères. The electro-motive force is 2·4 volts at the commencement and 1·9 volt at the end of the discharge.—A. S.

Analytical Chemistry, The Recent Theories of. P. T. Muller. Bull. Soc. Ind. Mulhouse, 1899, Feb., March, April, 63—73.

A short review of the theory of electrolytic dissociation and ionisation, with particular reference to the explanation which it offers of the reactions made use of in ordinary chemical analysis. Precipitation, action of indicators, and Ostwald's product of solubility are considered.—J. McC.

Cane Sugar, Electrolysis of Solutions of. K. Ulsch. Zeits. für Elektrochem. 1899, **5**, [47], 539—541.

Solutions of cane sugar were submitted to electrolysis under various conditions, platinum electrodes being used. The main action, consisting of the complete oxidation of the carbon of the sugar to carbon dioxide, was measured by absorbing the gas evolved. With simple addition of sulphuric acid the oxidation proceeded very slowly at the ordinary temperature; on increasing the current to 1 amp. and the temperature to that of a boiling water bath, carbon dioxide equivalent to 63 per cent. of the theoretical quantity was obtained after 1½ hours' treatment. Better results were obtained by adding to the cane-sugar solution a little manganous sulphate together with the acid; after 5 hours at 45° C., with one amp. current, an oxidation of 98 per cent. of the total carbon was effected. This influence of the manganous salt is attributable to the formation of higher oxides, as evidenced by the red coloration produced. With sulphuric acid of higher degrees of concentration, a noticeable evolution of ozone was observed. Caustic potash afforded a more rapid and complete oxidation of the dissolved sugar than sulphuric acid, and when the electrolysis was conducted first in the alkaline solution and then continued after acidification of the residual liquid, 99 per cent. of the carbon was oxidised to carbon dioxide. When sulphuric acid or caustic potash was used, the residue of 1—2 per cent. of carbon could never be oxidised by subsequent treatment with permanganate, the conclusion drawn being that a small quantity of the sugar had been converted, either into a volatile carbon compound, or else into a body oxidisable only with extreme difficulty. A more satisfactory solvent for the sugar was found to be baryta water, saturated in the cold; barium carbonate is formed directly at the anode during the process of oxidation. Electrolysis for several hours at 40°—80° C. did not give complete oxidation of the sugar, but the residue, in contrast to that with the other solvents, was oxidised quantitatively to carbon dioxide on subsequent treatment with acid permanganate on the boiling water bath.—J. F. B.

Electrodes for the Electrolysis of Alkali Chlorides. H. Becker. Ind. Electrochim. 1898, **2**, 25.

See under VII., *page* 583.

PATENTS.

Voltaic Battery Cell [Daniell] with Hot Air Depolarisation. H. de Rufz de Lavison, Neuilly-sur-Seine, France. Eng. Pat. 16,172, July 25, 1898.

The cell is heated to a temperature of from 30° to 60° C., and depolarisation is effected by fine jets of air moving along each face of the electrode, and injected into the electrolyte through fine holes in a tube placed under the base of each copper plate, and coming from a general conduit of compressed air.—G. H. R.

Ozone, Impts. in Apparatus [Portable] for Producing. M. Otto, Neuilly-sur-Seine, France. Eng. Pat. 17,260, Aug. 10, 1898.

A portable apparatus for producing ozone is described, which can be worked from either a continuous or an alternating electric light circuit. It consists of the ozoniser proper, provided with movable electrodes, a transformer, a dynamo, and a ventilator, and an arrangement of washing bottles or vessels containing appropriate products so as to enable atmospheric air to be utilised for the production of pure ozone. Two forms of the ozoniser are described, the first of which has a movable disc provided with pointed sectors, which is contained in a flattened cylindrical box, on the inner walls of which are fixed a series of conducting blades communicating with one pole of a high-tension transformer, whilst the disc is connected with the other. The second form consists of two concentric cylinders, the smaller of which is composed of a series of rectangular blades studded with points, and carried by two insulating discs electrically connected with each other.—G. H. R.

Electrolytical Apparatus, Impts. in. J. Loiselet, Paris. Eng. Pat. 22,872, Oct. 31, 1898.

The compartments containing the electrolyte comprise frames of wood or other non-conducting material, and walls of some porous substance having perforated sheets of metal in contact with them.—G. H. R.

Galvanic Batteries, Impts. in or applicable to. F. E. Singer, Stenn, Germany. Eng. Pat. 5619, March 15, 1899.

The carbons are coated with a thin layer of cement to prevent the adherence of any deposit or precipitate.
—G. H. R.

(*B.*)—ELECTRO-METALLURGY.

Palladium, Notes on the Electro-deposition of. S. Cowper-Coles. Trans. Inst. Mining and Metall., May 1899.

The author gives physical data relative to this metal, and then refers to its use for coating parabolic reflectors. For this purpose, a deposit of about 5 grms. per sq. ft. is recommended. The solutions used and results obtained by Smee, Bertrand, and Gore when attempting to deposit palladium electrolytically are enumerated, and the author closes by recommending that used by Bertrand. This electrolyte contains palladium ammonium chloride. The best proportions "are about a 0·62 per cent. solution of palladium ammonium chloride dissolved in about a 1 per cent. solution of ammonium chloride." This electrolyte should be used at a temperature of 75° F., with an E.M.F. of 4½ volts, and a current density of 0·12 ampère. The anodes can be either of palladium or carbon.—J. B. C. K.

PATENT.

Electro-plating, Impts. in Apparatus for. [*Rotating Shaft.*] H. Beckmann, Magdeburg, Germany. Eng. Pat. 6300, March 23, 1899.

The electro-plating apparatus consists of a tank containing a rotating shaft which is in connection with the negative pole of a battery. On this shaft is mounted a pair of wheels the shafts or members of which carry perforated chambers, which contain the articles to be plated; or when it is required to plate long articles, skeleton discs are employed, which can be placed at any required distance apart on the shaft.—G. H. R.

XII.—FATS, OILS, AND SOAP.

Mkani Fat and Oleodistearin. R. Henriques and H. Künne. Chem. Rev. Fett- u. Harz- Ind. **6**, [3], 45—49.

Two samples of this fat—obtained from the seeds of the East African tallow tree, *Stearodendron Stuhlmannii Engl.* —were examined by the authors, the one (I.) being from a freshly imported parcel, and the other (II.) several years old. The following constants were determined, the figures obtained by Heise being appended for comparison :—

——	I.	II.	Heise.
Specific gravity at 15° C.	0·9298	..	0·8926 (at 40° C.)
,, ,, 100	0·8606	..	0·85696
Acid number	11·6	20·7	23·33
Saponification value	186·6	191·7	190·45
Iodine value [W]	41·0	38·7	41·9
Unsaponifiable matter	1·21 per cent.	0·49 per cent.	..
Melting point	Complete liquefaction at 42° C.	..	40°—41°
Solidifying point	Small crystalline haze at 39°. Liquid until 29½°. Temperature rose to 36° on solidification.	..	30·4°—38°
Iodine value of the fatty acids	42·1	..	..
Melting point of the fatty acids	Complete at 61½°	..	59°
Solidifying point of the fatty acids (Titer test)	61·4°	61·6° C.	57½°

The high value of the last-named constant, coupled with the low percentage of unsaponifiable matter, confirms Heise's opinion of the utility of this fat for candle material, provided it can be obtained cheaply and in sufficient quantity. The large percentage of stearic acid which can be readily obtained in a pure state by recrystallisation from the mixed fatty acids, and the absence of palmitic acid, explain the high solidification point of the fatty acids.

By repeated recrystallisations from ether-alcohol, the authors obtained a snow-white crystalline body, readily soluble in ether, but only with difficulty in alcohol, and exhibiting the following constants :—Melting point, 45°—46° C. (39°—40° C. when re-melted); iodine value, 28·6; saponification value, 189·7; molecular weight (calculated), 295·2. This substance underwent no change on being recrystallised from absolute alcohol or acetic acid, and is therefore regarded as undoubtedly a definite chemical compound—oleodistearin—the constants being almost identical with those of this body.

The iodochloride of this substance was also successfully isolated, in almost quantitative amount, by treating the chloroform solution of the glyceride with an excess of Waller's reagent and addition of alcohol, after standing for six hours. On purifying the fine white acicular precipitate by recrystallisation from ether-alcohol, the following percentages were obtained by analysis :—Chlorine, 3·5; iodine, 12·4; the theoretical yield being 3·38 and 12·08 per cent. respectively.

This iodochloride resembles the original substance (oleodistearin). It is readily soluble in chloroform, ether, acetic ether, and acetone, but only with difficulty in ether-alcohol or alcohol. The melting point is 44½°—45½° C. (41½°—42½° when re-melted). The product is extremely stable, not being decomposed by boiling with dilute acids or by exposure to light. On saponification with alcoholic alkali, however, the greater part of the halogens are eliminated; a portion remains in combination, *viz.*, less than 1 per cent. of the iodine and about two-thirds of the total chlorine. This seems to controvert the view held by Wijs, that chlorine is more easily eliminated than iodine. Similarly, under the influence of concentrated sulphuric acid, the elimination of iodine preceded that of chlorine.

On the other hand, the halogens can be entirely removed by boiling the iodochloride with a large proportion of organic bases, such as aniline or quinoline, for an hour, and pouring the mass into an excess of dilute acid, whereupon oleodistearin separates free from halogen, about 75—80 per cent. of the theoretical amount being thus recovered. This result is due to the formation of iodochlorides of the organic bases used. Heating at 150° C. with alcoholic ammonia under a reflux condenser for three hours also reproduces the oleodistearin, the halogens being eliminated as iodine chloride.

Oleodistearin may be converted into elaïdodistearin by passing red nitrous fumes through the melted mass. The purified product melts at 61°, and resembles oleodistearin, but is less soluble in all solvents. It forms, with iodine chloride, elaïdodistearin iodochloride melting at 57°—58° C., and containing 15·52 per cent. of total halogens (theoretical, 15·46 per cent.). Elaïdodistearin and its products differ from their isomeric compounds in having only one melting point.

The authors have also isolated crystalline halogen compounds (possessing similar properties to those described) from butter and linseed oil, and have also prepared the iodochlorine compound of elaïdin; and they regard the method as a reliable means for detecting the presence of mixed glycerides in other vegetable and animal products.—C. S.

Wool Fat, and the Application of Wool-Fat Acids to the Solidification of Petroleum. C. Rosengren (Stockholm Chemical Society). Chem. Zeit. 1899, **23**, [35], 382.

Wool contains a variable amount of fat, the mean quantity being about 25 per cent. It can be extracted by the old washing method, which yields a product containing about 35 per cent. of saponifiable fatty acids, or by means of readily volatile solvents, which furnish a product with about 12 per cent. of saponifiable fatty acids. The fat obtained by solvents, is of an inferior quality, and contains considerable quantities of resin-like substances.

In 1893 a factory for the manufacture of lanolin was established in Stockholm. The wool fat was treated there in a series of emulsifying, separating, and dissociating cylinders, bleached with hypochlorite, washed, and subjected to fractional pressure. The product thus obtained was unable, however, to compete with a preparation manufactured in Bremen, and a new method has therefore been successfully introduced, and has resulted in a gain of 50 per cent. of pure wool-fat.

The resulting refuse has been used in making anhydrous, transparent, homogeneous solid products from petroleum. In this way it is possible to increase the consistency of different oils of low viscosity. Any required degree of consistency can be imparted to the oils, and the melting point can be raised to 152° C.

The new lubricants can be used for many purposes, and have already given good results in practice. It has hitherto been thought necessary for all solid lubricants to contain water if soap is to be retained in solution, but this is not the case with the new lubricants. These are prepared by dissolving wool-fat acids in petroleum, heating the solution to 120°—200° C., adding alkaline hydroxide in sufficient quantity to neutralise at least half of the fatty acids, and finally expelling the water of the hydroxide by heat. They are not affected by heat or cold, and have from five to eight times as great viscosity as solid lubricants which contain water.—C. A. M.

Beeswax, Amount of Hydrocarbons in. C. Ahrens and P. Hett. Zeits. öffentl. Chem. **5**, 91—95; Chem. Centr. 1899, **1**, [16], 952.

The amount of hydrocarbons in beeswax has been given by A. and P. Buisine as between 12·7 and 13·8 per cent., and by Kebler as between 12·5 and 14·5 per cent. The authors determined the amount by Buisine's method. 1 grm. of wax was heated to 100° C. in a hard glass cylinder in a small copper double-walled oven, 3·5—4 grms. of solid potash were gradually added with rotation of the tube, then 2 grms. of granulated potash lime, and the mixture heated slowly to 260° C., and kept at that temperature until the evolution of gas ceased. After cooling, 3 c.c. of water were added, and the whole heated for two hours at 100° C., in order to soften the melt. The mass was then removed from the tube, ground to a fine powder, the tube cleaned with gypsum, and the whole of the powder dried for 1—2 hours, pulverised, and extracted with alcohol. The hydrocarbons obtained should be practically free from fatty alcohols, and are dried for a short time at 100° C. and weighed. In this manner, the amounts of hydrocarbons in different kinds of wax were found to vary between 12·7 and 17·5 per cent.—A. S.

Linseed Oil, On the Iodine Value of. J. J. A. Wijs. Chem. Rev. Fett- u. Harz. Ind, **6**, [2], 29—31.

The differences in the results recorded by various observers are due to the divergent conditions of the several methods employed for determining the iodine value, the practice of taking the titre of the liquid after, instead of before the experiment being one cause of low values, whilst another cause is the insufficient time allowed for the reaction, particularly when the Hübl solution is not perfectly fresh.

The author has examined a large number of linseed oils by his iodine chloride and acetic acid method and finds the iodine values range within the following limits :—

Dutch linseed.—Friesland, 195·3—201·8; Groningen, 197·4—199·3; Zeeland, 193·5.

British India linseed.—Bombay, 182·3—187·5; Calcutta, 182·2—182·8.

La Plata linseed.—174·7—182·7.

North American linseed.—177·8—188·5.

North Russian linseed.—188·5—198·2, one sample from Riga seed giving the value 200·0; *Central Russian linseed*, 188·9—189·1; *South Russian linseed*, 176·3—182·5.

Danubian linseed.—182·1.

The foregoing were oils from unmixed seed, the results yielded by oils from mixed seed being given in the appended table :—

Mixture.	Iodine Values.
Dutch, Memel	199·1
Petersburg, Pernau, Konigsberg	198·4
⅓ Viatka, ⅓ Petersburg, ⅓ Frisian	197·5
Viatka, Petersburg, Frisian	195·7
½ Petersburg, ½ Frisian	195·4
½ North Russian, ½ Frisian	195·1
⅔ Azov, ⅓ Dorpat	185·5
$\frac{9}{10}$ La Plata, $\frac{1}{10}$ Azov	183·7
½ Azov, ¼ La Plata, ⅛ Calcutta, ⅛ North American	183·3
½ La Plata, ⅓ Bombay, ⅙ Taganrog	183·2
½ Azov, ⅜ Bombay, ⅛ La Plata	182·9
⅔ Bombay, ⅓ Taganrog	182·7
Bombay, Azov	181·5
South Russian, British Indian, North American	181·1
½ Bombay, ½ Azov	180·9
⅔ La Plata, ⅙ Bombay, ⅙ Calcutta	180·1
La Plata, Azov, Bombay	178·7

24 samples examined for specific gravity gave the following result :—

1	with an iodine value	> 200	=	sp. gr.	0·9352
4	„	195·1—200, averaged		„	0·9339
4	„	190·1—195,	„	„	0·9329
4	„	185·1—190,	„	„	0·9322
6	„	180·1—185,	„	„	0·9317
5	„	< 180·1	=	„	0·9310

Apart from home-grown seed, which is fairly pure, the chief kinds dealt with at Amsterdam are La Plata—seldom containing more than 5 per cent. of foreign (mostly non-oleaginous) seeds; Indian—with rarely more than 6 per cent. of impurities, except one Calcutta grade, where they amount to about 30 per cent. of foreign oil-seeds; South Russian, fairly pure; and North Russian, containing 5, 10, and even 20 per cent. of impurities, mostly oleaginous seeds. —C. S.

Fish Oils, Saponification Value of. W. Fahrion. Chem. Rev. Fett- u. Harz- Ind. **6**, [2], 25—29.

The following values were obtained by the author in a carefully conducted series of experiments :—

Oil.	Iodine Value.	Henriques' Cold Saponification Method.		Warm Saponification with Henriques' Alkali Solution.	Becker Method.	"Inner" Saponification Value, Fahrion Method.
		24 Hours.	2—8 Days.			
Sardine oil	191·7	189·5—195·9	192·5—216·8	190·9—193·8	196·2—200·3	185·2—186·4
Stickleback oil	162·0	183·2—190·7	184·5—200·9	186·6—189·9	190·6—192·6	181·1—181·5
Seal oil	146·2	186·0—190·4	186·7—197·4	190·7—192·9	189·8—193·5	184·4—186·0
Haddock liver oil	166·2	182·3—183·3	183·5—185·5	182·5—183·0	187·8—188·3	181·6—181·9
Japan fish oil	108·5	186·0—186·8	186·1—189·2	186·6—186·8	189·3—191·4	180·0—180·9
Whale oil	106·1	184·0—185·1	184·5—188·0	184·4—185·5	191·2—193·5	174·8—175·7
Linseed oil (old)	172·0	187·0—187·7	187·0—188·6	187·6—189·1	188·8—192·3	186·8—187·9

The high values furnished by the first three oils in the cold saponification method (eight days) are abnormal, and are considered to be due to the presence of oxidised fatty acids. In the warm method the percentage of water in the alkali exercises a considerable influence on the results, as is shown in the figures obtained with Henriques' solution (3—4 per cent. of water) and Becker's alkali (16 per cent. of water); the latter is not recommended for fats that are difficult to saponify; in fact it is best to dissolve the alkali direct in 96 per cent. alcohol for warm saponification.

On determining the amount of oxidised fatty acids, a total of 0·1568 grm. of these acids and 0·0148 grm. of volatile fatty acids was isolated from 10 grms. of sardine oil; 0·117 grm. of oxidised fatty acids and 0·0315 grm. of volatile fatty acids being obtained from 10 grms. of stickleback oil.

The erroneous values resulting from the presence of these acids during saponification, are avoided when the excess of alkali in the reagent is avoided, as is the case in the author's "inner" saponification value method (Zeits. angew. Chem. 1898, 782), wherein the oxidised and volatile acids are removed by extraction with petroleum spirit and evaporation respectively, the latter operation being preferably effected on the water bath, to prevent any modification of the fatty acids by overheating.—C. S.

Cotton-Seed Oil, Halphen's Reaction for the Detection of. P. Soltsien. Zeits. Offentl. Chem. **5**, 106; Chem. Centr. 1899, **1**, [18], 1049.

See under XXIII., *page* 611.

Boiled Linseed Oil, Distinguishing Ordinary Linseed Oil from. F. Evers. Chem. Zeit. 1899, **23**, [31], 334.

See under XXIII., *page* 612.

Eriococcus Coriaceus, The Colouring Matter of; and the Wax of Ceroplastes Rubens. E. H. Gurney. Rep. of the Australasian Assoc. for the Advancement of Science, Sydney, 1898, Section B., 273.

See under IV., *page* 573.

PATENTS.

Sulphur Compounds of Mineral Oils and similar Hydrocarbons, Impts. in and relating to. L. O. Helmers, Hamburg. Eng. Pat. 10,875, May 12, 1898.

See under XX., *page* 606.

Fats and Oils, Deodorising and Decolorising; Impts. in. E. Andreoli, London. Eng. Pat. 14,569, July 1, 1898.

The oil or fat is melted in water, the mass constantly stirred, and a dilute solution of a sulphide, sulphite, or hypochlorite (preferably the hypochlorite of zinc, aluminium, ammonium, or especially magnesium) added in small portions at a time. If necessary, the treatment is repeated with a fresh charge of the bleaching solution, and the fat is finally washed with hot water.—C. A. M.

Wool and other Animal Fibre, Impts. in the Treatment of the Wash Liquors from, to recover the Grease and Potash therefrom. J. Smith and Sons, Ltd., and W. Leach, Bradford. Eng. Pat. 15,131, July 9, 1898.

The liquid is concentrated to such a density that the fatty matter can be separated by mechanical means such as centrifugal force, and the lanolin (or other fat) and potash separately recovered and purified. Claim is also made for treating the residual portion, after removal of the fatty layer, by concentrating it further to a paste by evaporation, calcining the residue in a rotary or other furnace to remove organic impurities, and purifying the potash in the ash by crystallisation or other means.—C. A. M.

Oils and Essential Oils, Impts. in the Treatment of, and particularly of Drying Oils. C. de la Roche, Paris. Eng. Pat. 26,539, Dec. 15, 1898.

Claim is made for a process of treating the cold oil with calcium carbide, leaving the mixture to settle, and separating the clear oil by decantation or filtration. The sediment contains the water with mucilaginous substances carried down by the lime. It is stated that oils thus treated are clearer, have superior drying properties, and form more brilliant and permanent varnishes than oils as usually employed.—C. A. M.

Oil, Recovering and Purifying; Impts. in Apparatus for. H. H. Lake, London. From V. Camiz, Venice, and A. Gobba, Scrivia, Italy. Eng. Pat. 6069, March 20, 1899.

This invention is for the recovery of waste oil when mixed with water, as in the bilge water of ships. In the latter case, for example, the mixed water and oil are pumped into the bottom of the inner of two concentric vessels (the "recuperator"), which is open at the top. In this it gradually rises until it reaches the top, where the water falls into the external cylinder, leaving part of the grease on the flanges on the edge of the inner chamber. As soon as the exterior chamber is full, oil mixed with water and dirt rises into the "aërator," a vessel connected with the recuperator by a pipe. Here it accumulates until, on reaching a float, the water in the recuperating vessel enters a waste pipe and is discharged through a valve at the top. Simultaneously, the float in the aërator is raised by the oil, and opens in its upward motion a valve through which any air drawn up by the pumps, can escape. From the aërator the impure oil falls through a pipe with a cock into the "separator," where a preliminary separation of oil and water takes place by gravitation, means being provided for the return of this water to the hold of the ship. Finally, the oil is drawn off from the upper part of the separator and passes into the "purifier," which may consist of one or two similar vessels provided with spiral steam pipes and gauge cocks. It is stated that with mineral oil, purification may be effected by simply boiling for 15 minutes and allowing the oil to settle; but with olive oil or mixtures of olive oil and mineral oil, an addition of from 4 to 6 per cent. of soda or other saponifying agent is necessary, the boiling and treatment with alkali being repeated if required. The quantity of mineral oil recoverable, amounts to about 75 per cent. of that present, whilst in the case of olive oil, from 45 to 60 per cent. can be recovered.

A settling tank may also be used in conjunction with this apparatus.—C. A. M.

Soap, Resinous, Improved Apparatus for the Manufacture of. F. Arledter, London. Eng. Pat. 2822, Feb. 8, 1899.

This apparatus is for the manufacture of soap containing more than 30 per cent. of "unsaponaceous rosin." It consists of a stationary boiler in which the rosin and alkali are boiled under pressure. This is surrounded by a steam-jacket to only about half its height, the object of which is to prevent the rosin melting too rapidly, and to ensure more complete saponification. The inner boiler is provided with a false bottom covered with a coarse wire net. Near the bottom of the boiler is a finer wire net to retain finer impurities. The manhole is surrounded by an iron ring in which is a channel, the edges of which form two sharp-edged points. The manhole-cover is also grooved in such a manner that when screwed down it touches the manhole ring in four points, forming as many steam-tight rings. By this device the necessity for packing is avoided. In use, the boiler is filled with water nearly to the false bottom, on which the alkali is placed. When this is dissolved by steam blown in, the rosin is introduced and full steam turned on. After a few hours the liquid mass is blown through a filter which is divided into three compartments by perforated plates and heated by means of a steam-jacket.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Casein for Paints, Use of. Papier Zeit. 1899, **24**, [33], 1251.

Casein may be used with advantage in place of oil for mixing paints. To make such paints work freely under the brush, the addition of a small quantity of ammonia is recommended. Extreme care should be taken in dissolving the casein. The solution is easily effected at a temperature between 70° and 75° C. At a higher temperature it begins, like albumin, to coagulate, and to lose its binding power. —S. K.

PATENTS.

Water Composition or Paint, A New or Improved Damp-resisting Washable Sanitary. T. Cardiff, Dublin. Eng. Pat. 12,038, May 27, 1898.

(1) One cwt. of "roached" lime, 28 lb. of sugar crystals, and 28 galls. of boiling water, strained and allowed to settle; (2) 84 lb. of whiting and 8 galls. of the liquid from (1). Equal parts of (1) and (2) mixed together and tinted to shade with any ordinary colour.—F. H. L.

Reducing Litharge and other Lead Oxides to Suboxide, Impts. in Apparatus for. G. Bischof, London. Eng. Pat. 13,202, June 13, 1898.

In Eng. Pat. 11,602, 1890 (this Journal, 1891, 841), the patentee described a process for converting the litharge and other lead oxides of commerce into lead suboxide by means of water-gas before working them up into white lead with acetic acid and carbon dioxide. In the present specification apparatus is described which is specially designed for carrying out this reduction. It consists of a vertical cylinder fitted with an agitator, an inlet for the lead oxide at the top, an inlet for the water-gas near the base, and an outlet for the lead suboxide at the bottom. It is surrounded by a metal jacket in which gas is burnt to raise the temperature of the material to 250° or 300° C.; but the lowest portion of the chamber is contracted in diameter, and is water-jacketed to cool the suboxide, before it emerges into the air.—F. H. L.

Preservative Paint, or Coating Material for Pasteboard Roofing Material and the like. C. N. Nielsen, Frisenborg per Ikast Station, Denmark. Eng. Pat. 417, Jan. 7, 1899.

Coal tar, 55 per cent.; waterground chalk, 20 per cent.; Gilchrist-Thomas slag, 15 per cent.; burnt clay, 9·5 per cent.; turpentine, 0·5 per cent.: are made into a paste and applied to the extent of about 4 oz. per square foot, in order to render pasteboard roofs water-tight, &c.—F. H. L.

(*B.*)—RESINS, VARNISHES.

Dammar Resin. A. Zucker. Pharm. Zeit. 1899, **44**, [1], 6.

Dammar resin is derived from *Dammara alba*, *Hopea splendida*, *H.-micrantha*, and *Engelhardita spicata*, coniferous trees indigenous to the Moluccas. It occurs in dull, powdery, colourless, or light yellow, irregular pieces, with a conchoidal fracture, which soften with the warmth of the hand; it becomes quite plastic at 75° C., and melts to a thick fluid at 100° C., and at 150° C. it is quite fluid. It is soluble in fatty and volatile oils, in chloroform, and in benzene, and partially so in alcohol and in ether. It consists of dammarylic acid, 80 per cent.; resin, 19 per cent.; and gum, about 1 per cent. It is secreted in the form of "tears," from large nodular excrescences near the roots, or on the lower portions of the trunks of the trees. In varnishes, its chief application is for pictures, since it is very clear and transparent, but does not dry so hard as copal. The so-called Australian dammar appears to be Kauri copal, derived from the Kauri pine of New Zealand. These pine trees do not grow in large numbers together, but in isolated clumps, which impart a characteristic appearance to the landscape. The largest attain a height of 30 metres and a girth of 4—5 metres. The resin is at first opaque and milky, but ultimately becomes amber-coloured. As it exudes, it collects in large masses at the foot of the tree. Large pieces of resin are not so often met with now as formerly, since the Chinese, who monopolise the trade, break them up and mix them with the clearer pieces, since the small fragments are of better appearance and are clearer and more transparent. In this way it is possible to mix off a large proportion of second-rate resin with a little of good quality. To such an extent has the adulteration of the resin by the Chinese been carried that the Batavian commercial authorities have attempted to regulate the trade, and have fixed the limit of impurity at 28 per cent.—J. O. B.

Camphor Oil, Technical Application of the Higher Boiling Fractions of. Schimmel's Semi-Annual Rept. Leipsic, April, 1899, 8.

See under XX., *page* 605.

PATENT.

Priming or Varnish for Violins and other Musical Instruments, An Improved. T. O. Windsor, Croydon. Eng. Pat. 5371, March 11, 1899.

The silk glands from 20 or 30 silkworms which are just beginning to spin, are removed and agitated with 2 oz. of distilled water to make a gummy liquid. This is used as a size for the unprimed wood of the violins, &c., which are then finished with a water or spirit varnish. The product is claimed to fill up the pores of the wood and greatly to increase its resonant qualities.—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Leather Analysis, Notes on. T. Palmer and M. Willenez. Bull. Assoc. Belge des Chim. **13**, [4], 189—194.

The actual weight (density) of a given volume (100 c.c.) of leather—determined by weighing a number of discs, of known dimensions, cut from the sample—affords a good indication of quality, and should exceed 124 (grms.). Weights between 121 and 123 are admissible, but indicate incomplete tanning, and leathers prepared by the quick method of tanning do not greatly exceed 110, whilst really bad grades weigh 85—87. In samples weighing 110—115, loading with glucose, barium chloride, aluminium chloride, lead sulphate, &c., may be expected. Thin hides from hot countries are superior in density and quality to the thicker hides yielded by animals in cold climates. Loaded leathers are open in texture and exhibit a high coefficient of absorption of moisture per unit of time (weight of water absorbed in one hour divided by weight of extractive matter); and this coefficient varies inversely with the density of the leather; *e.g.*, 0·000174 for a sample weighing 130·7 grms. per 100 c.c., and 0·000384 for another weighing 87·6. By dividing the coefficient of absorption × 1,000,000, by the density, a series of direct values for quality can be obtained, the results being, in the two instances cited, 1·33 (best leather) and 4·38 (inferior grade) respectively.—C. S.

Glue, Animal and Vegetable, Method of Distinguishing. F. Evers. Chem. Zeit. 1899, **23**, [31], 333.

See under XXIII., *page* 612.

PATENTS.

Hides and Skins, Impts. in the Art of Preparing for Tanning, and in Liquid Composition of Matter for Treating such. H. Holmes, Philadelphia, U.S.A. Eng. Pat. 26,390, Dec. 13, 1898.

Hides and skins in the raw state are treated with a bath consisting of a solution of sodium sulphide and a demulcent, such as chalk or whiting, held in suspension, the object being to swell the fibre, soften the gristle, and dissolve animal and refuse matters therefrom, and so prepare them for the subsequent tanning operations. The bath may be made in about the following proportions:—Sodium sulphide, 100 lb.; chalk or whiting, 25 lb.; made up with about 80 galls. of water, more or less, according to the nature of the hides or skins to be treated.—J. G. P.

Treatment of Size by Boiling, Impts. in Apparatus for the continuous. A. Stephan, Brietenbach, near Munster, Germany. Eng. Pat. 2059, Jan. 30, 1899.

This invention relates to improvements in Eng. Pat. 5164, 1898 (this Journal, 1898, 660), already granted to the above. In the said apparatus the raw sizing material is mixed, but the quite fresh and already boiled substance is not separated. To remedy this defect, and render the apparatus more efficient in respect to quantity and quality of the size thereby produced, the improvement consists in "the employment of one or more suitably-shaped discs, in any suitable combination, upon the shaft of the boiler, which discs may be solid or have ports, and be run in contact with or clear of the interior of the boiler, and be secured to their shaft at a right angle or inclined thereto, for the purpose of separating the various stages in the boiling of the sizing material, and causing the latter to pass from one stage to the other gradually, according to its development."—J. G. P.

Artificial Leather, and Process for Manufacturing the same, Improved. H. L. B. Moerch, Frederiksberg, Denmark. Eng. Pat. 4235, Feb. 25, 1899.

The invention relates to the production of artificial leather, consisting of felt made of "vegetable fibres and wool, embedded in a compound of linseed oil, turpentine, glue, caseine, and wax." "Vegetable fibres are felted together with wool; and the felt formed in this way is saturated with a compound formed by mixing and heating linseed oil, colophony, turpentine, wax, glycerin, glue, casein, and a smaller quantity of borax and bichromate of potash, is partly dried, and then placed in a solution of acetate of alumina, whereupon the drying is completed and the manufacture rubbed off, pressed between heated rollers, and glazed." The article thus produced is said to be in every respect very much like real sole leather, and may be worked in the same way as the latter.—J. G. P.

XV.—MANURES, Etc.

Perchlorate in Chili Saltpetre. B. Sjollema. Deut. Landw. Presse. 1897, No. 22, 195.

A reply to Wagner (this Journal, 1898, **17**, 168; see also *ibid.* 1160). The author has not stated that 0·5 per cent. of perchlorate is injurious to crops, but only considered it as probable; experiments have shown that an application of 150—160 kilos. of saltpetre per hectare, containing 1·4 per cent. of perchlorate, is very injurious to rye. The perchlorate is very unevenly distributed in nitrate of soda, and it is difficult to ascertain its actual percentage. Rye seems to be more easily injured than other crops, and amounts of perchlorate may be too small to cause visible injury and yet diminish the yield.

Experiments made by de Caluwe, in which small plots (2 sq. metres) received 52·5 grms. of nitrate of soda, proved that, whilst the crop showed no signs of injury in the first months, a distinctly injurious effect was observed on some plots after 4—5 months, even when only 1 per cent. of perchlorate was present.—N. H. J. M.

Bone Superphosphate, Methods for detecting the Adulteration of, with other Superphosphates. F. Dupont. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [8], 767.

See under XXIII., *page* 609.

Phosphates, A New Solvent for distinguishing the Phosphoric Acid in various. W. Hoffmeister. Landw. Versuchs.-Stat. 1898, **50**, 363.

See under XXIII., *page* 611.

PATENT.

Mineral Phosphates, An Impt. in the Treatment of. Electric Reduction Company, Limited, London. From W. T. Gibbs, Quebec, Canada. Eng. Pat. 13,134, June 11, 1898.

In decomposing mineral phosphates by heat, silicious or aluminous potash or soda-bearing minerals, such as felspar, are substituted for the silica usually employed. The carbon added, may be insufficient to decompose all the phosphoric acid present, so that the slag may contain phosphates useful as fertilisers. But if all the phosphates be decomposed, the slag is available as a source of alum, on treatment with sulphuric acid.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Mauritius [Sugar]: Annual Report on the Work carried on at the Station Agronomique during 1897, pp. 1—84.

(1) *Remarks on the Improvement of the Sugar Cane by Selection* (pp. 47—50).—The herein-described experiments have been carried out with a view to the elucidation of the question of the improvement of the varieties of cultivated canes by selection, or their degeneration, due to the methods usually employed for their propagation.

In the experiments on selection, the canes were taken which had the same outward appearance as regards growth and vegetation, and, as far as possible, the same age. The central portions of the canes were then crushed for the analysis of the juice, and the extremities reserved for planting by the eyes or buds. Several canes were, on the basis of the analysis of the juices, divided into two categories, rich and poor, and the buds from the upper part of the canes were planted and grown under similar conditions in two plots. When these canes had reached maturity, the richest were selected from the rich plot and the poorest from the poor plot, and again planted out. From the rich plot only those canes were taken which yielded juices having a density varying from 107·4 to 108·2, whilst from the poor plot the canes yielding juices of a density between the limits of 106·1 to 107·4 were chosen. The mixed juices of each plot had the following composition :—

——		Rich Division.	Poor Division.
Density of juice at 15°		108·1	104·4
Per 100 c.c.	Sucrose	19·14	16·19
	Glucose	0·43	0·87
Per 100 of canes	Sucrose	14·86	13·60
	Glucose	0·33	0·73
Quotient of glucose		2·2	5·3
Purity		88·5	88·90

These two crops were again planted out, and the resulting crop of the rich and poor divisions showed very little difference on analysis. Rich and poor canes were again selected, and a third crop grown, the mixed juices of which had the composition—

——		Rich Division.	Poor Division.
Density of juice at 15°		108·4	107·6
Per 100 of juice	Sucrose	18·41	17·28
	Glucose	0·48	0·72
Per 100 of cane	Sucrose	15·46	13·49
	Glucose	0·40	0·54
Quotient of glucose		2·6	4·1
Purity		89·7	86·1

These experiments are being continued.

(2) *Cane Tops or Cuttings* (pp. 50—53).—The method generally employed for propagating the sugar cane, is by planting the top or upper portion of the cane; this method has been at times denounced as the principal cause of degeneration of some varieties, but this effect is far from being proved, and until now no marked difference has been observed to result from the use for propagation, either of the top or of cuttings from the cane itself, the two buds being taken under similar conditions. The bud of the cane tops possesses indisputable advantages, the principal of which are the utilisation for planting of a portion of the cane of no value in sugar manufacture, and the easier and more rapid growth made by the shoots after planting.

In the first planting the tops were set separately in one plot, and the cuttings in sections with three eyes each in another. The planting made in Jan. 1894 and reaped in Dec. 1895, gave the following results :—

——		Louzier Canes.		Port McKay Canes.	
		Tops.	Cuttings.	Tops.	Cuttings.
Yield in canes per acre		50·6	31·7	56·0	40·2
Density of juice at 15°		108·2	107·85	107·7	107·6
Per 100 c.c. of juice	Sucrose	19·60	18·71	17·85	17·64
	Glucose	0·41	0·47	0·79	0·90
Per 100 of canes	Sucrose	15·42	14·57	13·91	13·76
	Glucose	0·31	0·36	0·61	0·70
Quotient of glucose		2·0	2·4	6·4	5·1
Purity		90·0	90·3	87·6	87·8

The next table shows the composition of the same canes cut as first rattoons in Dec. 1896 :—

——		Louzier Canes.		Port McKay Canes.	
		Tops.	Cuttings.	Tops.	Cuttings.
Yield in canes per acre		38·90	35·30	27·70	18·40
Density of juice at 15°		108·8	109·0	108·1	108·2
Per 100 c.c. of juice	Sucrose	21·74	22·27	18·70	19·60
	Glucose	0·30	0·19	1·30	0·78
Per 100 of canes	Sucrose	16·78	17·15	14·53	15·21
	Glucose	0·22	0·14	1·00	0·60
Quotient of glucose		1·3	0·8	6·9	3·9
Purity		93·80	93·6	86·9	90·0

It thus appears that the plantings with tops are far from being inferior to the other; the proportion of sucrose is sometimes in excess, sometimes lower, whilst the yield of canes per acre is in every case higher. The excess of yield is due in the first place to the more rapid and vigorous growth made by the upper buds of the plant; those of the lower joints have a dormant vitality, and sprout with more or less difficulty, whilst the nearer they are to the top the more active is their growth. The top buds contain less sugar, but it is not proved that this sugar is necessary to the nutriment of the shoots. All the buds of the same cane form part of the same individual, and if variations occur, as is the case with all vegetables, there is no reason why the accidental modifications should be more beneficial, from a cultural point of view, in the lower than in the upper buds.

(3) *Scum Cakes* (pp. 65—66).—The scum obtained from defecation is never used in Mauritius as food for cattle. It is pointed out that with a little insistence, cattle would take to it, and in support of this the West Indies are quoted as an example where scum cake is considered to be a highly valuable food for stock, and particularly for bringing draught cattle, worn out by the crop work, into good condition again. The value of 100 kilos. of "Scum cake" is stated to be Rs. 1·886, compared with Rs. 10·0 for the same quantity of "Gram."

Molasses (pp. 66—67).—Although, owing to present prices, it is advantageous to use molasses for manure, it would be better to use them for feeding purposes. The use of molasses as an adjunct to cane leaves is suggested; but, having regard to their low nitrogenous contents, it would be advisable to add more nitrogenous matters from leguminous plants, or oil cakes, the use of which is unknown in Mauritius, and which could probably be procured cheaply from India or Australia.—J. L. B.

Sugar Works, Undetermined Losses in, and Means for Diminishing them. H. Pellet. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [8], 745—758. (This Journal, 1899, 505.)

THE general conclusions on undetermined losses of sugar are the following:—

The real loss of sugar in the beetroot, from its reception to its entry into the factory as fresh pulp, is variable, according to the mode of ensilage, the length of time it is preserved, and the prevailing weather; also with the time the roots are in contact with water during hydraulic transport, washing, the quantity of water absorbed or retained, the adhering earth, &c. Taking account of everything, the richness of the fresh pulp may be 0·50 to 0·60 per cent. below that of the beetroots when received. But the weight of matter worked up is different, and variable with the deficit corresponding to the rootlets, tails, and *débris* rejected before the roots are sent to the weighing machines.

There are no undetermined losses in diffusion, expressed as sugar or polarimetric degrees, when every care is taken in weighing, sampling, measurement, and analysis of beetroots, of the fresh pulp, diffusion juice, exhausted pulp, sweet waters, &c. When there are losses, hitherto admitted as undetermined, they are always shown by an increase in reducing matters or by a diminution of the coefficient of purity. From these the corresponding loss of sugar may be calculated.

The quantity of sugar transformed, expressed in degrees of polarisation, may be calculated with great precision by following the coefficient of purity of all the products from the carbonated juice to the molasses.

In general, the loss of sugar during concentration is very small, or *nil* when work is quick, but the loss may become sensible when there is any delay.

The determinable losses are in the exhausted pulp, in the sweet waters, in the waters of the heaters, in the scums, in the cloths of the filter presses and mechanical filters both for juice and syrups, in the ammoniacal waters, in the various waters of condensation, and in the sugar given as overweight in each sack.

The indeterminable losses are principally the mechanical losses, that is, losses of juice and syrup by entrainment during carbonating and evaporation, loss of juice in the press-house, loss of syrup, of massecuite, and of finished sugar. Now it is possible to unite all the waters discharged from the factory and find the sugar lost thereby, to be added to the other determinable losses. Very little sugar in the boilers will soon make its presence known, by the characteristic odour resulting from the presence of sugar in the feed water. The loss of finished sugar can only be small under ordinary conditions of work,—as dust carried away out of the factory.

By studying the manufacture step by step, in the search for working losses, it is at once clear what means should be adopted for diminishing or suppressing them. It may possibly be recognised that the beetroot worked up is less rich than it is generally supposed to be, but it will no longer be admitted that there can exist any of the considerable undetermined losses which have hitherto caused such ill consequences. It has often been stated that a beetroot too rich in sugar did not give a proportional yield of sugar, and that the unknown losses were increased: that it was to one's interest to work up only beetroots of medium quality, &c., &c. Such erroneous conclusions were doubtless due to the inexact determination of the richness of the beetroot by indirect methods. A summary of the chemical control of two sugar works in Holland from the season of 1893-94 to the present time shows that the conclusion with regard to richer beetroots was a false one.
—L. J. de W.

Sugar Factories, Waste Waters of. F. Hueppe. Arch. Hyg. 1899, **35**, 19; through Chem. Zeit. Rep. 1899, **23**, [16], 152.

THE author cites an example showing the extremely bad effect of the waste waters of sugar factories on the water courses into which they are discharged. The stream in this case was rendered not only unsuitable for fish culture, but also for driving a mill, since the sulphuretted hydrogen evolved when the water was churned up, imparted an evil odour to the products of the mill. The treatment of these waters with lime was very inefficient; but even when sufficient lime was added, matters were very little better, since a large proportion of it separated as carbonate, and was inactive. A complete fixation of sulphuretted hydrogen is not effected by milk of lime, and the addition of metallic salts with the lime does not assist the clarification, and decreases the disinfecting effect. The author advocates the application to the effluents of sugar factories, of some of the improvements latterly adopted for the treatment of town sewage.—J. F. B.

Sugar Liquors, Verley Process for the Purification of, by Ozone. K. Andrlik. Zeits. Zuckerind. Böhmen, 1899, **23**, [5], 314—323.

THE Verley process for the purification of beetroot juice by ozone, as worked during last season at Noyon, Oise, France, consists in treating liquors of about 20 B. with ozonised air, which is drawn through the cooled liquor (25°—30° C.) for 2—4 hours; afterwards compressed sulphurous acid gas is passed in, in the cold, until an acidity of 0·02 per cent. is reached, and barium hydrate added to faint alkaline reaction; the liquor is boiled, filtered, and concentrated to massecuite.

The process requires a special arrangement for producing ozonised air, and receivers for ozonising, sulphuring, and neutralisation of the juice, a filter press suitable for retaining fine precipitates as barium sulphate, a cooler for the juice, a washer to remove oxides of nitrogen, and an air pump to draw the ozonised air through the juice.

The ozoniser works with greatest efficiency when a litre of the air contains from 2—3 mgrms. of ozone. Theoretically, one horse power per hour should develop 1,050 grms. of ozone in the Verley apparatus, but under the above conditions, 250 grms. of ozone are produced.

For treating the juice of 2,000 quintals (200 tons) of beetroots daily, 100 ozonisers are used, grouped 20 together, in tiers of four. The dynamo is driven by a 100-h.p. engine (only 75 h.p. being used), giving a current of 220—230 volts and 24—30 ampères. By a Verley transformer this is raised 12,000 volts, and then used for ozonising. The ozonised air passes through leaden pipes to the purifier containing caustic soda lye at 30° B. to remove oxides of nitrogen. It is next passed through a cylindrical iron tank of 100 hectolitres (2,200 galls.) capacity, containing 60 hectolitres of the liquor to be treated. The liquor is then treated with sulphurous acid and neutralised with barium hydrate. The finely divided precipitate of organic substances and barium sulphite and sulphate necessitates the use of special English filter cloths and a reliable filter press.

The first effect of the ozonised air is a fall in the alkalinity and a darkening of the liquor, followed by decolorising. In practice the process is interrupted as soon as an improvement in the colour begins. The liquor is then slightly turbid and distinctly darker than it was originally. Only a slight increase in purity is caused by ozone alone, since only a small part of the organic non-sugar is oxidised, but another portion is rendered precipitable by barium hydrate.

After filtration, the liquor boils well to a masseeuite in five hours instead of eight, and gives a greater yield of "grainy" sugar. It is distinguished by an absence of the characteristic beetroot odour, which has given place to a more agreeable smell. No invert sugar is formed, whence it may be concluded that the oxidation is confined to the non-sugar. The inorganic constituents remain unaltered. Nitrogenous compounds are not decreased in amount by the process, although it is possible they may be altered.
—L. J. de W.

Beetroot Juice, Darkening of. M. Gonnermann. Chem. Zeit. 1899, **23,** [20], 213—215, and [22], 240—242.

It is now well known that fresh diffusion juice, which is of a wine-red colour, darkens in the air from above downwards, as may be observed in a glass cylinder filled with the juice. Although the colouring matter of the darkened juice could not be separated from other impurities by treatment with lime and alcohol, it was found that the juice from the pulp of boiled beetroots did not darken on exposure, nor did fresh pulp which was received into alcohol immediately it was made.

Beetroot slices being thicker, the colouring factors act more quickly than the alcohol can diffuse into the cells.

The pulp treated with alcohol, may be dried in the air without any change of colour. From an examination of the juice of potatoes, the author obtained microscopic crystals, some of which were recognised as tyrosin, but on attempting to isolate them, he could not obtain the tyrosin reaction with Millons's reagent; still he has no hesitation in assuming the presence of tyrosin in potato and beetroot juices.

The readiness with which juice darkens is dependent on chemico-physiological changes in the beetroot. Albuminous bodies are first changed by enzymes into tyrosin, and the latter is further so altered, that it only needs the oxygen of the air to cause the darkening of the juice. The author has already shown (Zeits. Rübenzuckerind. 1898, 684) that the so-called tyrosinase may be identical with beetroot enzymes, since these also act on tyrosin, causing it to darken. After the reaction, no crystals of tyrosin could be found, but the residue gave a reaction with Millon's reagent, indicating that the rearrangement of the atoms had taken place in the side chain, leaving the aromatic group unaltered. Basic acetate of lead gives no precipitate in a solution of tyrosin, and enzyme solution only a very slight precipitate. Tyrosin is easily soluble in ammonia. The dark liquid resulting from the action of the enzyme on tyrosin, gives an abundant precipitate with basic acetate of lead, and the black precipitate is insoluble in ammonia. By allowing the enzyme to act with the air excluded, the author found that the beetroot enzyme is not an oxydase, as Bertrand assumes, but that oxygen is necessary for the darkening to take place (the solution having remained scarcely coloured, though blackening quickly on exposure). The dark substance is recognised as dihydroxyphenylacetic acid. It was not found possible to separate this acid from juice which had already become dark, but by allowing fresh, uncoloured beetroot pulp to remain eight days in a current of hydrogen, in order to allow the enzyme time to act on the albuminous bodies and tyrosin, the flask was placed in boiling water for two hours, when the pulp was treated with hot distilled water, cooled, and pressed. The slightly grey juice was acidified with phosphoric acid, and then ammonia added in slight excess. A cherry-red colour was produced, showing the presence of dihydroxyphenylacetic acid.
—L. J. de W.

Beet Sugar Manufacture, Presence of Cholesterin in Products of. E. O. von Lippmann. Ber. 1899, **32,** [8], 1210—1212.

Some years ago the author isolated an alcohol from the foam of some after-products of a beet-sugar refinery, which he identified with the phytosterin of Hesse, its melting-point being 133° C., and $[\alpha]_D = -33^\circ\cdot68$ to $-35^\circ\cdot11$, according to concentration. Later, he found the same body in the scums of another refinery. Recently he noticed a characteristic foam on the runnings from the raw sugar in the refinery, and after much difficulty isolated a substance of a similar nature, the higher constants of which, m.p. 145° C., and $[\alpha]_D = -40^\circ\cdot23$, indicated the probability of its being an isomeric member of the cholesterin group. This substance was examined by Schulze, who reported that it was completely identical with the ordinary animal cholesterin from gall-stones and wool-fat. The author remarks that this cholesterin could not possibly have originated from the lubricants used at the refinery, which were wholly mineral, and regards the existence of cholesterins in the vegetable kingdom as fully established.—J. F. B.

Crystallisable Sugar, Process for Obtaining the whole Quantity of, contained in Green Syrups (First Jet). F. Hlavati. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16,** [8], 759—766.

The result is to be obtained:—Firstly, by precipitating the alkali bicarbonates and soluble calcium phosphates, these salts being the principal cause of the loss of sugar, and the same salts prevent the precipitation of albuminoid matters in the green syrup, by combining with them and rendering them soluble. Secondly, by transforming the chlorides of calcium, potassium and magnesium, and magnesium sulphate, which prevent crystallisation of sugar, and eliminating them as far as possible. Thirdly, by precipitating albumin and other organic matters as far as possible.

Tartaric acid is added to precipitate the potash as cream of tartar, and then metaphosphoric acid and ammonium metaphosphate in quantity equivalent to the salts of sodium, magnesium, and the alkaline earths, converting the latter into metaphosphates, which are almost insoluble and easily removed from the green syrup. Metaphosphoric acid precipitates albumin.

As an alternative, hydrofluosilicic acid or its ammonium salt may be used.

After removing the salts, certain organic matters are added to precipitate the albumin, caseïn, and partially decomposed nitrogenous matters, which still remain. Equal parts of *Cæsalpinia coriaria* and sumach, in amount, equivalent to the albuminoid matter, &c., present in the green syrup, and four times the quantity of gypsum, are used. The mixture is heated by steam to 70° C., and, after cooling to 30° C., it is filtered. A further purification may be effected by means of hyposulphurous (hydrosulphurous) acid.

A much larger yield of sugar than usual is thus realised, for all the crystallisable sugar of the molasses is obtained in the form of "cassonade," of first quality.—L. J. de W.

Sugar Bacterium, A. H. M. Ward and J. R. Green. Proc. Roy. Soc. 1899, **65,** [414], 65—84.

The authors have examined a curious combination of organisms obtained in Paris, and stated to occur as an excrescence on sugar canes in Madagascar. It forms large gelatinous clumps in saccharine solutions, resembling those of the "ginger beer plant," yielding an effervescent acid drink. The constituent organisms were separated by anaerobic plate cultures on sugar gelatin and were found to consist of at least one yeast, apparently a variety of *S. cerevisiæ*, which was not further investigated, and a bacterium, with properties analogous to those of *Leuconostoc*. On sugar gelatin this bacterium forms dome-shaped, stiff, gelatinous zooglœa masses, and on sugar agar it forms flat, slimy colonies. It refuses to grow in any medium not containing sugar. Cane sugar is by far the most favourable food, and the only one in which the property of producing viscosity or gelatinous masses is observed. Glucose and fructose are not well suited to the growth of the bacterium; and a mixture of these sugars, whilst allowing of a vigorous growth, does not show any evidence of viscosity or zooglœa masses; the bacteria settle from the limpid solution in an unsheathed, flocculent form. The other carbohydrates are practically unavailable as nutrients for this bacterium. The addition of boiled yeast water to the media stimulates the growth of the organism very considerably; yeast water, sterilised only by filtration through porcelain, prevents its growth even in cane-sugar solutions. Either the porcelain filter holds back some body necessary for the nutrition of the bacterium or destroys it in its passage; also the raw yeast extract in some way spoils the cane sugar as a food for the organism, probably by rapid inversion, and yet the bacterium flourishes in the natural state side by side with a living yeast. The authors incline to the opinion that the gelatinous matrix, holding the bacteria and the cause of the viscosity and opalescence of cane-sugar culture media, consists simply of the swollen cell-walls or sheaths of the individual organisms, and is not a metabolic product outside the cells. This gelatinous matter is a hemicellulose, closely related to the dextran described by Scheibler. As with ***Leuconostoc***, the presence of calcium chloride in the culture media favours the production of the jelly; but the authors think that, in spite of certain similarities, the differences are sufficient to indicate that their organism is not identical with ***Leuconostoc***. Artificial mixtures of the bacterium with the yeast did not produce the gelatinous clumps of the original combination. Comparative fermentations were made with the original combination, the yeast and bacterium separately, and with mixtures of the two, in various media. The acids of fermentation are acetic and succinic, and the greater part of this acidity is produced by the bacterium. With cane sugar alone and in presence of fructose, the acidity produced by the conjoint organisms was less than by the bacterium alone, with glucose the reverse was the case. The presence of 0·1 per cent. of acetic acid was favourable to the yeast, but more than 0·25 per cent. was detrimental. The bacterium produces more than 0·5 per cent. of acid, and does not conduce to any increase of growth or activity of the yeast, but rather the reverse. The yeast, on the other hand, helps the bacterium by excreting certain extractive matters of considerable nutritive value to the latter. The acetic acid is produced by the bacterium directly from the sugar, and not from the alcohol; the authors have proved that the enzyme invertase is secreted by this bacterium.—J. F. B.

Maize Stalks, The Reducing and Invertible Sugars of. C. Istrati and G. Oettinger. Comptes Rend. 1899, **128**, [17], 1040—1043.

Tables are given showing the weights of the trimmed stalks, the quantity and density of the expressed juice, the optical and reducing powers of extracted and expressed juices before and after inversion with hydrochloric acid (10 minutes at 78° C.) of maize at various stages of development and of 16 different varieties at maturity. The deductions drawn by the authors are:—That the weight of the stalk decreases as its volume increases during development, because it loses more water than it assimilates of solid matter in the formation of fibre; consequently the quantity of juice diminishes with the age of the plant, but its density increases. The optical effect of the juice up to the 62nd day of vegetation is generally lævo-rotatory, as the plant matures, the lævo-rotation decreases, and finally the effect is dextro-rotatory. The quantity of reducing sugar is always increased after inversion; the invertible sugar amounts to at least twice the reducing sugar, and increases with the age of the plant to four times. The invertible sugar in the green stalks after 80 days vegetation averaged 1·89 per cent., the richest variety being Hungarian *Dreher*, with 2·7 per cent. The invertible sugar in the dry mature stalk is very much higher, averaging 8·62 per cent.; the Transylvanian variety, *Seckel*, contained 16·69 per cent., an early variety, ripe on July 1st, 14·3 per cent.; the American white, 13·32 per cent.; and Roumanian, 10·56 per cent.—J. F. B.

Maize Stalks, The Reducing and Invertible Sugar of. C. Istrati and G. Oettinger. Comptes Rend. 1899, **128**, 1115.

When the ears of the maize plants were cut off as soon as they formed, the weight of the stalks, the density of the juice, the dry substance, and the reducing and invertible sugar all increased. The reducing sugar, after inversion in the green stalks 95 days old, rose to 2·68 per cent. instead of 1·89 per cent. when the ears were left on. The sugar in the dry stalks also rose from 8·62 per cent. to 10·76 per cent. in the decapitated stalks. The effect of cutting off the ears varied largely in the different varieties. Out of 15 varieties, 10 showed an increase in invertible sugar when ears were not allowed to develop, the sugar in the variety *Alseuter*, increasing 8·75 times; five varieties, however, suffered a decrease of sugar when the ears were cut off, the sugar in *Seckel* decreasing in the ratio 1·84 to 1, and these varieties are also those which have the highest sugar content when grown in the normal state, hence their cultivation is an advantage, affording a maximum of sugar together with a yield of corn.—J. F. B.

Cane Sugar, Electrolysis of Solutions of. K. Ulsch. Zeits. für Elektrochem. 1899, **5**, [47], 539.

See under XI. A., *page* 589.

PATENTS.

Beet, Cane, and other Sugars, Impts. in or connected with the Manufacture and Refining of. C. J. Crosfield and Sigmund Stein, Liverpool. Eng. Pat. 8592, April 13, 1898.

The patentees claim the following process:—Raw sugar juices which have been limed and carbonated, or which are in an acid state, are well mixed with hydrogen peroxide in quantities varying from 0·005 to 3 per cent. The juice is then made acid to the extent of 0·005 to 0·4 per cent. with phosphoric acid or other phosphoric compound. By this treatment the hydrogen peroxide destroys the colouring matters of a basic character, the acid converts these bases into salts, and precipitates them, the free organic acid being driven off completely in the subsequent heating and boiling operations. After filtration, the juice may be acidified with from 0·05 to 0·1 per cent. of sulphurous acid, and the precipitate of sulphide of lime removed by passing through a filter press. The thin liquor is concentrated to about 25° to 29° B., filtered, and boiled to crystals. The massecuite is of a light colour, and if washed with a concentrated sugar solution containing a small quantity of hydrogen peroxide (which in some cases is stated to be advantageous) in a centrifugal machine, fine bright crystals suitable for consumption are obtained.

The refining of raw sugar is effected by rendering the solution acid to the extent of 0·02 per cent., and then adding at a temperature of 180° F. and at a concentration of 27° B. 0·01 to 1 per cent. of aluminium sulphate or other suitable aluminous compound; and subsequently with from 0·005 to 0·6 per cent. of tannic acid; then with 0·5 to 2 per cent. of phosphoric acid or suitable phosphate. By this treatment the colouring matters are partly destroyed. In some cases the juice may, in addition, be subjected to the action of sulphurous acid. The liquor is now filtered, and from 0·01 to 1 per cent. of hydrogen peroxide added, also phosphate of soda or other phosphate to the extent of 0·005 to 0·2 per cent. The subsequent treatment of the juice is similar to that described in the first instance.—J. L. B.

Cube Sugar, Impts. in or connected with the Manufacture of. C. J. Crosfield and Sigmund Stein, Liverpool. Eng. Pat. 8593, April 13, 1898.

White crystals or raw sugar crystals which have been washed and made white, are mixed in an apparatus such as is used for making dough, with just a sufficient quantity of a clear saturated sugar solution as will cause the crystals to adhere to one another. The stiff material is then made into slabs or cakes by pressing it direct from the hopper of the mixing apparatus into matrices in a press. The moist slabs are dried in a stove, and conveyed to a cutting machine, where they are cut up into cubes, the cutting being so effected that four sides out of the six have a crystalline and brilliant surface.

The claims comprise the mixing together of sugar crystals and sugar solution by mixing machinery, pressing, and discharging the pressed cakes from the machine.—J. L. B.

Food for Animals, and the Method of Preparing the same; A New or Improved Material. G. F. Thompson. From J. S. Cochran, Pa., U.S.A. Eng. Pat. 12,685, June 7, 1898.

See under XVIII. A., *page* 601.

Filtering and Decolorising [Sugar] Materials; Impts. in the Manufacture and Treatment of. R. W. Barker, London. From C. Catlett, Staunton, Virginia, U.S.A. Eng. Pat. 114, Jan. 3, 1899.

A substitute for animal charcoal and other similar filtering and decolorising media is made by taking the necessary quantity of clay, adding a solution of a low grade sugar or syrup in such proportion that the solid contents would represent about 14 per cent. and not more than 25 per cent. of the weight of the clay, mixing thoroughly, drying, and granulating by suitable means. The granulated mixture is then heated in closed retorts, so as to bake the clay without fusing it, and char the carbonaceous matter. Solutions of other carbonaceous materials may be used instead of sugar, and the clay instead of granulating may be moulded into filtering discs, tubes, &c. Some clays found in the United States naturally contain sufficient carbonaceous matter, and require only to be mixed with water, dried, granulated, and baked. The proportion of solid carbon in the finished product should not exceed 8·33 per cent.

A second part of the invention relates to the revivifying of spent filtering material which has become inefficient through the accumulation of an excess of carbon in its pores. The inventor finds that this excess of carbon can be gradually burnt out by reheating the material in closed retorts after cooling and exposure to air, combustion being effected by atmospheric oxygen, which is absorbed by the material during the cooling process.—L. A.

XVII.—BREWING, WINES, SPIRITS, Etc.

Saaz, Frohberg, and Logos Yeasts in Cane Sugar Solutions, Influence of Acetic and Lactic Acids upon. R. Meissner. Bayerisch. Brauerjournal, 1899, **9**, 160; through Chem. Zeit. Rep. 1899, **23**, [16], 151.

The author allowed a known quantity of yeast to ferment a 10 per cent. solution of cane sugar with yeast water to which known quantities of the organic acids had been added. The above beer yeasts were unable to withstand so large a proportion of acetic or lactic acid as the pure cultures (wine yeasts) studied by Lafar.

Saaz and Frohberg lost their activity in presence of 0·25 per cent. of acetic acid, and Logos with 0·375 per cent.; They were still more sensitive towards lactic acid. As regards the production of alcohol, no great differences were found between the experiments made with and without the addition of acetic acid. The production of acid was noticeably greater with lactic than with acetic acid. The fermentative energy when acetic acid was added, was greater with Saaz and Logos and less with Frohberg, than in absence of acid. Addition of lactic acid reduced the fermentative energy of all three yeasts.—J. F. B.

Yeast, Expressed Extract of.—II. A. Wroblewski. Anz. Akad. Wissensch. Krakau. 1899, [3], 115; through Chem. Zeit. Rep. 1899, **23**, [16], 151. (See this Journal, 1899, 156.)

The author found that the fermentation of sugar by the extract expressed from commercial yeast was measurable, but only very slight. He detected two new enzymes, though these may be two properties of one and the same enzyme. One is capable of hydrolysing glycogen, and is present in fairly large quantities; it resembles the proteolytic enzyme, and was obtained in precipitating the invertase. The other is a starch-transforming enzyme, and was not always present, and then only in small quantities.

On acidifying the extract with phosphoric acid, filtering and distilling, formic acid was always found in the distillate. By extraction with ether a substance related to cholesterin was isolated, besides volatile oily bodies, and a compound crystallising in needles. As to the constitution of protoplasm, the author's view is that it consists of a thin liquid, and a thick, semi-solid substratum. All the protoplasmic molecules of the thick substratum possess an identical, highly reactive, proteïd nucleus, to which in different places various substances are attached as side-groups and chains; in the thin liquid part of the protoplasm various bodies are held in solution. Then, especially at the places of contact of the substrata, layers of mucin, invertase, zymase, and other enzymes, and nucleoprotein may be stored up and exert their specific effects upon the substances surrounding them. Some of these stored up substances may be insoluble and, therefore, inseparable from the protoplasm, as for instance zymase.—J. F. B.

Wine-Yeasts, Pure. I. Schukow. Zeits. für Spiritusind. 1899, **22**, [18], 157—158.

The author has examined a large number of wine-yeasts with special regard to their suitability for the distilling industry and the extent of their fermentation of malt worts. The question whether they belong to the top or the bottom fermentation type was tested by observing their effect on raffinose (melitriose). Solutions of this sugar are completely fermented by bottom fermentation yeasts, whilst top fermentation varieties only ferment the levulose residue (one-third of the whole), and the resulting solution reduces Fehling's solution owing to the presence of melibiose. The results showed that all the 50 races of wine-yeasts examined by the author, only partially fermented raffinose solutions, and therefore belong to the top-fermentation type as defined by the above test. The extent of the fermentation of malt worts by these yeasts as compared with known types of beer yeasts was determined by sowing them in a hopped beer-wort of 11·6° Balling and fermenting at 25°—25·5° C. for 15—20 days. The vast majority of the wine-yeasts examined gave a final gravity of 4·4°—4·8° Balling, corresponding to an apparent attenuation of 62·1 to 58·7 per cent., which classes them with the Saaz type of beer-yeast. The only exception was Nieder-Ingelheim wine-yeast, which reduced the gravity to 3·2° Balling corresponding to 72·4 per cent. and which is classed with Frohberg beer-yeast. None of the yeasts approached the attenuation of 92·3 per cent. given by Logos yeast, but a Jamaican variety, *S. melacei*, showed 81·1 per cent. approximating to Pombé yeast with 83·7 per cent.—J. F. B.

Wine Must, Effect of Heating the Crushed Grapes prior to the Extraction of the. A. Rosenstiehl. Comptes Rend. 1899, **128**, [17], 1050—1052.

In 1896 the author published results showing that careful heating of the crushed grapes before obtaining the must, caused an increased extraction of colouring matter, sterilisation of the musts, and wine of a superior quality. In the vintages of 1897 and 1898, over 100,000 kilos. of grapes have been treated by his method with the most satisfactory results, the wines being in all cases superior to control wines prepared in the ordinary manner. Besides increasing the colouring matter, the preliminary heating destroys the elasticity of the solid parts of the grapes, rendering them more susceptible to the pressing, with the result that 1,000 kilos. of grapes yielded 810 litres of sweet must as against 700 litres of wine under ordinary conditions. The expressed juice was much richer in colour and the fermented wine had more body than that obtained from grapes which had not been heated and had not been subjected to pressure, the latter in general being superior to pressed wines. The sterilisation of the musts permitted the study of the effects of culture yeasts and of yeasts from selected vintages and mixtures of the two on identical musts. The expert tasters made no distinction between the wines of the three classes, but the percentage of alcohol was different with the different yeasts. In all cases the heated grapes gave wines of higher alcohol percentage than the control experiments, but in the case of the former, those fermented with culture yeasts showed a slightly higher proportion of alcohol than with crude fine-vintage yeasts. The treatment of the grapes by this process protected the wines from sickness and only the untreated wines subsequently became "turned" when exposed to infection.—J. F. B.

Denatured Spirits, Purification of, by Chloride of Lime. A. and P. Buisine. J. Pharm. et Chim. 1899, **9**, [9], 429—431.

The authors disagree with the statement of Duchemin (see this Journal, 1899, 388) that the denaturing of spirits with methyl-ethyl ketone affords an insufficient security for the Excise. According to Duchemin the treatment of such denatured spirits with a solution of chloride of lime and a little milk of lime in the cold, filtration after two hours' contact, and subsequent rectification, suffice to remove the acetone, yielding 95 per cent. of alcohol with good flavour. This treatment was prescribed by Arachequesne in 1896 for the recovery of spirits denatured in the ordinary way with wood spirit (this Journal, 1897, 156). The present authors contend that the acetone oils from wool grease contain matters other than methyl ethyl ketone, which are unacted on by chloride of lime, and these substances are sufficiently disagreeable to spoil the recovered spirit. Also, spirits recovered by the above process, retain chlorinated compounds which are easily detected and which cannot be entirely eliminated. The action of chloride of lime on the acetones is not complete, and traces of the latter can be detected in the recovered spirit, by means of phenylhydrazine or hydroxylamine. Such spirits are unfit for consumption on account of the odour which persists, and for burning, on account of the chlorine compounds. The authors consider that acetone oil is preferable to wood-spirit for methylating purposes.—J. F. B.

Skim Milk and Whey [Milk Wine], New Alcoholic Fermentation Product from. A. Ekstrand. Chem. Zeit. Rep. 1899, **23**, [7], 64. (From Milch. Zeit. 1899, **28**, 21.)

It is known that the Tartars obtain from mares' milk a milk wine, which is prepared by utilising the ferment contained in the so-called kephir seeds. This ferment is capable of decomposing milk sugar into alcohol and carbonic acid, a power not possessed by common beer and wine yeasts. During the past few years, particularly in the Pasteur Institute, several other forms have been discovered, and pure cultivations made, able to ferment milk sugar; one of these, yielding a drink containing 3 to 4 per cent. of alcohol, and therefore of a strength comparable to that of strong beer, and possessing a fresh, sparkling flavour, similar to that of fruit wines.

As skim milk and whey generally contain only 4 to 5 per cent. of milk sugar, they must be concentrated to half the volume to give a drink of the above alcoholic content. They may also be fermented in their original condition. As skim milk has only a small value, it is possible in this way to obtain at a low price a refreshing and nutritious beverage. The alcoholic liquid may also be used for preparing vinegar.
—L. J. de W.

Alcoholic Fermentation, Influence of the Pancreas on. Lépine and Mortz. Comptes Rend. **128**, [15], 904.

See under XXIV., *page* 616.

Caramel in Spirits and Vinegar, Detection of. C. A. Crampton and J. D. Simons. J. Amer. Chem. Soc. 1899, **21**, [4], 355.

See under XXIII., *page* 612.

PATENTS.

Matured Stock Beers, Impts. in the Treatment of. F. Faulkner, J. E. J. Johnson, and the Non-Deposit Beer Co., Birmingham. Eng. Pat. 6433, March 24, 1899.

The claims relate to the reconditioning of matured stock beer by adding to the beer in cask a proportion of saccharine matter and a ferment sufficient to generate the necessary quantity of gas. Storing the beer thus treated at a comparatively warm temperature (55° F.), and agitating it from time to time until the saccharine matter is attenuated; afterwards storing at a low temperature (30° F.) to allow super-saturation with the carbon dioxide to take place and finally filtering it under pressure.—J. F. B.

Worts, Improved Process for Fermenting. J. Effront, Brussels. Eng. Pat. 9615, April 26, 1898.

The inventor claims the process described in an abstract of Belgian Pat. 134,692 (this Journal, 1898, 939), for fermenting dextrinated worts by means of a yeast acclimatised towards such worts, by repeated fermentations in presence of gradually increased proportions of dextrin and decreased proportions of sugar. The use of potassium nitrate and of formic aldehyde at a suitable stage of the process is also claimed.—J. F. B.

Production of Alcohol from Farinaceous Matter, Compounds for Use as Ferments for. H. G. Turner, London. Eng. Pat. 10,809, May 11, 1898.

The patentee claims the use of the compounds known in India as "Saraimandie" (white ball) and "Atsumandie" (brown ball) as ferments for the production of alcohol from farinaceous substances. The active principles of these ferments are mucors, and small quantities are mixed with equal proportions of rice meal and the bark of *plumbago zeylanica* and *nerium tinctorium* for the preparation of "white balls," and with the same barks but without the rice, and in some cases with vegetable ingredients for "brown balls." The mixture is made into a paste, shaped into small balls, and exposed to a warm moist atmosphere. The balls are then dried at fire heat; for production of alcohol, they are mixed with farinaceous matter, when, by agency of the mould, fermentation is set up and alcohol produced.
—J. L. B.

Extracts of Malt, Hops, and other Substances, Impts. in the Process for Producing. G. G. Cave, Fenny Stratford, Buckingham, and H. S. Stoneham, London. Eng. Pat. 13,880, June 22, 1898.

The process claimed is for producing extracts of malt, hops, and other substances, concentrating the filtered infusion or other liquid preparation or natural liquid, by heating for the necessary time at a high temperature, care being taken to avoid caramelisation. The concentrate is then heated in a separate apparatus at a lower temperature, and run into suitable receptacles.—J. L. B.

Maturing or Treating Wines and Spirits, Process and Apparatus for. J. E. Carroll, London. Eng. Pat. 14,152, June 30, 1898.

In this invention the maturing of wine and spirits is claimed, by heating them, to a temperature above the boiling point, in a vessel of special construction. If desired, the liquid which is being treated may be drawn off, and condensed in a worm or other condensing apparatus, instead of allowing it to cool in the vessel in which it has been heated. The liquid is then filtered and cleared in a suitable manner. A claim is made for the apparatus in which this treatment is carried out. It comprises a pump to force the vapour or liquid into a chamber where the heating takes place, communication pipes fitted with back valves to and from the reheating apparatus, a condensing worm where the heated vapour is condensed, also a filter clearing- or settling-apparatus for clarifying the resulting liquid.—J. L. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Pea, Proteids of the. T. Osborne and G. Campbell. Zeits. Landw. Vers. Wes. Öst. **2**, 160—173. Chem. Centr. 1899, **1**, [16], 937.

The authors discovered the following proteids in the pea:—Legumin; vicilin; legumelin; a proto-proteose precipitated by acetic acid from its solution saturated with salt, and with the composition: carbon, 50·24; hydrogen, 6·76; nitrogen, 17·35; sulphur, 1·25; oxygen, 24·40 per cent.; and a deuteroproteose not precipitated by acetic acid from its solution when saturated with salt, composition: carbon, 49·66; hydrogen, 6·78; nitrogen, 16·57; sulphur, 1·40; and oxygen, 25·59 per cent. The total content of legumin and vicilin found by dialysis of the pea-extract amounted to about 10 per cent. (See also this Journal, 1898, 784 and 941.)—A. S.

Coffee, Analysis of Samples Roasted by Different Methods. L. Goblet. Bull. Assoc. Belge des Chim. **13**, [4], 172—173.

The author compared samples roasted on the old system in closed cylinders with those roasted in perforated cylinders wherein the berries are exposed to the direct action of a gas flame (new system), and found that with an equal caffeine content (0·87 per cent.) in both cases, the new system furnished a product containing twice as much of the aromatic principle, caffeol, as the older method, *viz.*, 0·035 against 0·018 per cent.

The caffeol was extracted by the Fremy-Bouhon method —distilling a weighed quantity of coffee with a known weight of water and agitating the distillate with ether. In driving off the solvent, the presence of a small quantity of water necessitates evaporation at a low temperature, in order to prevent loss of caffeol. Good results are obtained by evaporating in a desiccator over calcium chloride or sulphuric acid. The caffeol was estimated by the method in which sodium benzoate is employed as solvent. —C. S.

Coffee, Glazing. T. F. Hanausek. Zeits. f. Unters. d. Nahr.- und Genussmittel, **2**, (1899), 275—279.

The so-called glazing of roasted coffee which dates from the time of Liebig, is intended to prevent the loss of aroma in roasting and on keeping. Hitherto sugar (2—10 per cent. of the weight of the berries) has been employed for this purpose, but latterly the use of rosin and shellac has been proposed. Some investigators maintain that the use of sugar is prejudicial, since the acid empyreumatic vapours first given off are retained by the sugar; and, in the second phase of roasting, the faintly alkaline vapours accompanied by aromatic substances can be retained without its help by careful roasting and cooling. The authorities of the imperial laboratory for the investigation of food materials in Vienna, have reported on a sample of coffee berries glazed with shellac as follows:—The berries glazed with shellac preserve their aroma better than the unglazed. They possess a lacquered appearance different from coffee as ordinarily roasted. No cases are known of the employment of varnishes as preservatives. Glazing increases very slightly the weight of the roasted berries (0·575 per cent.). No difference can be detected in the flavour of the extract, but about 1·74 per cent. less is extracted from the glazed berries. From a hygienic point of view a shellac glaze is harmless, and, as already mentioned, the appearance of the berries at once shows that they are artificially glazed, although it is possible that a purchaser might be misled as to the value of an inferior coffee treated in this way. The method cannot be patented in Austria, and although harmless, coffee glazed with shellac ought, in the interest of the consumer, to be described as such.—T. A. L.

Water-Vine, Water of the. W. M. Doherty. Rep. of the Australasian Assoc. for the Advancement of Science, Sydney, 1898, Section B, 335.

One of the means by which travellers in tropical and subtropical Australia are able to allay thirst, is to be found in the water from the water-vine (*Vitus hypoglauca?*). The water is obtained either by cutting off several lengths of the vine and allowing it to drain, or, if a large quantity be required, by cutting deeply into a fairly large specimen near the ground, and then, less deeply, as high up from the ground as possible, when a copious flow of water is obtained. The water is clear, sparkling, and palatable, but with a faintly acid taste. It contains 39 grains of solid matter per gallon, 28 grains of which consist chiefly of tannin and some allied substance, causing the water to darken on exposure to air, together with some proteid substances. The remaining 11 grains of solid matter contained potassium, sodium, calcium, magnesium, chlorine, sulphuric acid, phosphoric acid, carbonic acid, &c.—A. S.

Milk, Tinned Condensed; Analyses of. F. S. Hyde. J. Amer. Chem. Soc. 1899, **21**, [5], 439—443.

The following analyses of different brands of condensed milk were made in 1895. In each case the milk was diluted with three times its weight of water, and this liquid used as the stock solution for each of the determinations. The total solids were obtained by evaporating about 5 grms. of the solution on the water-bath, and drying the residue for 15 minutes in an air-bath at 100° C. The fat was estimated by the Adams' coil method, the milk sugar by titration with Fehling's solution, and the cane sugar by inversion with citric acid, titration, and deduction of the amount of milk sugar (in terms of cane sugar) previously determined.

The following are the numbers obtained, and they represent the extreme limits of results in each case. Total solids = 71·16 to 79·12; milk solids = 30·76 to 47·29; milk sugar = 9·50 to 17·20; cane sugar = 28·94 to 42·96; fat = 7·84 to 10·56; casein, albumin, salts, &c., by difference = 9·89 to 25·95. Water = 20·88 to 28·84.

The last three analyses in the table given, represent the so-called "evaporated milks." The numbers obtained are also given. The following are the extremes:—Total solids = 30·46 to 35·24; milk solids = 30·46 to 35·24; milk sugar = 10·15 to 12·32; cane sugar = none. Fat = 6·73 to 11·82. Casein, albumin, salts, &c. (difference) = 11·10 to 13·58. Water = 64·76 to 69·54.

The author finds that the specific gravity of condensed milk may vary from 1·27 to 1·37, according to the quantity of cane sugar added, or relative amount of proteids and fat in the milk used.

He regards the old Fehling method as preferable to polarimetric methods of determining the sugars, since, apart from other reasons, it is stated that the heating, during the condensation of the milk, alters the rotatory power of milk-sugar, without seriously affecting its cupric reducing power.

A law of New York State requires that "no condensed milk shall be made . . . . . . unless the proportion of milk solids shall be, in quantity, the equivalent of twelve per centum of milk solids in crude milk, and of which solids twenty-five per centum shall be fats."

According to the author, the amount of fat is generally less than 10 per cent. of the whole, or less than 25 per cent. of the 40 per cent. (more or less) of total milk solids. —C. A. M.

Carbohydrates, Notes on the Estimation of. F. W. Traphagen and W. M. Cobleigh. J. Amer. Chem. Soc. 1899, **21**, [4], 369.

See under XXIII., *page* 613.

Butter, Non-Volatile Fatty Acids in; Use of Resazurine as Indicator in Estimating. A. Lemoine. Bull. Assoc. Belge des Chim. **13**, [4], 187.

See under XXIII., *page* 614.

Oatmeal, Estimation of Wheatmeal in, by a Gravimetric. W. M. Doherty. Rep. of the Australasian Assoc. for the Advancement of Science, Sydney, 1898, Section B, 336.

See under XXIII., *page* 614.

PATENTS.

Food Products from Milk, Impts. in the Manufacture of. A. Bernstein, Berlin. Eng. Pat. 10,903, May 12, 1898.

The improvements claimed, consist in reducing albuminous casein paste to the form of a fine powder. The pasty casein is finely divided by forcing it through a perforated plate; and the small particles so obtained are then air-dried at 90° F., and ground.—W. P. S.

Artificial Butter, Impts. in the Manufacture of. M. E. O. Liebreich, Berlin. Eng. Pat. 12,355, June 1, 1898.

Use is made of the aqueous extract of cocoa-nuts, sweet almonds, hazel nuts, &c. (containing "emulsin"), in place of milk in the manufacture of margarine.—W. P. S.

Food [Meat Extracts], Impts. in the Manufacture of. J. A. Timmis, London. Eng. Pat. 15,407, July 13, 1898.

The improvements claimed, consist in extracting the entire ground-up carcase with water, at a temperature of about 50° C., then further extracting at or above 100° C., mixing the extracts, and concentrating them with the addition of flour and vegetables or vegetable extracts.—W. P. S.

Food for Animals, and the Method of Preparing the same : A New or Improved Material. G. F. Thompson. From J. S. Cochran, Philadelphia, U.S.A. Eng. Pat. 12,685, June 7, 1898.

The food claimed, consists of spent sugar cane (" bagasse "), freed from all pithy matter, and cut up into "chaff." It is for use alone, or mixed with other foods.—W. P. S.

Cereals and Legumes for Food Purposes, and of their Use in the Manufacture of an Improved Flour and Meal for Bread and Biscuit Making ; Impts. in the Malting of, or otherwise Treating. J. T. O'Callaghan, London. Eng. Pat. 3686, Feb. 20, 1899.

The patentee decorticates and bakes cereals or legumes, allows them to cool, and saturates the same with liquid extract of barley malt. The cereals are then dried at 140° F., and ground, or they may be flaked before drying.

In the case of maize and rice, liquid extracts of malted maize and of malted unhusked rice are used in the place of the barley malt extract.

The ground products are mixed with flour for bread-making. When extra nourishment is required, the extract of malt is mixed with unsweetened condensed milk and lime water, before being poured on the cooked cereals (not legumes). If not immediately used, the treated cereal may be kept in air-tight canisters.—W. P. S.

Preserving and Distributing Liquids [Beverages], Method of and Means for. J. C. Chapman, London. From H. V. Walker, New York, U.S.A. Eng. Pat. 4897, March 6, 1899.

The method claimed, consists in filling the liquid (milk, syrups, cider, beer, &c.) into " siphons," and then forcing sterilised air into the same. The siphon, with its contents, is afterwards subjected to a sterilising temperature.—W. P. S.

Preserving Bread and other Articles of Food, Improved Method of ; and Apparatus therefor. M. Marx, Crefeld, Germany. Eng. Pat. 7175, April 5, 1899.

According to this patent the loaves, hot from the oven, are placed in hermetically-closed tins until required for use. The loaf rests on a grating or false bottom in the tin.
—W. P. S.

Condensed Tea, Improved. A. Sureya Bey Emin, and P. Rahgi, Constantinople. Eng. Pat. 8525, April 12, 1898.

Tea is extracted with water and alcohol for some days ; the extract is then concentrated and evaporated *in vacuo* (with or without the addition of milk or sugar) to a syrupy or solid consistency.—W. P. S.

(*B.*)—SANITATION ; WATER PURIFICATION.

Drinking-Water, Purification and Sterilisation of. H. Bergé. Ann. des Trav. publ. de Belg. 1898, 369.

Experiments have been carried out by the author, in conjunction with A. Bergé and E. Stein, as to the sterilising power of chlorine peroxide, ClO_2, a gas which, by following the author's directions, can be prepared without danger at the ordinary temperature by the action of sulphuric acid (64° B.) on potassium chlorate. A description is given of the experiments made on various waters, showing the complete sterilisation induced by this gas ; and particulars are given of various ways in which practical use can be made of the discovery in treating large quantities of water.—A. S.

Drinking Water, Industrial Sterilisation of, by Ozone. Marmier and Abraham. Comptes Rend. 1899, **128**, [17], 1034—1035.

The authors have treated the town water of Lille by their ozonising process on an industrial scale. The electrical part of the factory comprises a transformer, giving a secondary current of 30,000 volts. The ozone generators are worked with the aid of Hertzian sparks (compare this Journal, 1898, 930), and are characterised by a special arrangement for cooling, whereby the refrigerating water circulates without interruption and simultaneously in both series of electrodes. The water is filtered and treated by systematic circulation with the ozonised air in a masonry column. The commission appointed by the town reported very favourably on the process, remarking that all pathogenic and saprophytic organisms present in the water had been destroyed by the treatment, with the exception of a few germs of *B. subtilis*, which are very resistant. The water, on account of the destruction of organic matter, is less liable to subsequent putrefaction.—J. F. B.

Mineral Waters, Fluorine supposed to be contained in certain. F. Parmentier. Comptes Rend. 1899, **128**, [18], 1100—1101.

Certain mineral springs, particularly those of Mont-Dore and St. Honoré-les-Bains, have been stated to contain volatile fluorine compounds. The only evidence on which this idea is based is the fact that the glass drinking vessels are apparently attacked, and after some time become opaque, as if they had been submitted to the action of hydrofluoric acid vapours, whilst wooden or gutta-percha vessels are unaffected. The author states, however, that since these waters are themselves very rich in dissolved silica, and contain alkali and earthy bicarbonates, the presence of a volatile fluorine compound capable of attacking glass is, *a priori*, inconceivable. Moreover, he has proved that the opacity is due to the deposition of an exceedingly adherent film of silica and calcium carbonate, which may be scraped with a knife, and which, after short local treatment with dilute hydrofluoric acid, gives effects the converse of those obtained by etching glass with hydrofluoric acid, namely, transparent spots where the deposit has been dissolved on the protected opaque ground. No traces of calcium fluoride or any other fluorine compound could be detected in these waters.—J. F. B.

Drinking Water, Sodium Peroxide as a Disinfectant for. F. Blatz. Apoth. Zeit. **13**, 1898, 728—729.

The use of hydrogen peroxide as a disinfectant has the drawback of expense, and it, moreover, always contains free hydrochloric or sulphuric acid. These disadvantages are not shared by sodium peroxide, and the author proposes to add to the water, previously to adding the sodium peroxide, the equivalent amount of citric acid ; for 234 parts of Na_2O_2, 420 parts of citric acid. The bacteriological investigations show that with a proportion of 1 : 1,000, a water containing many bacteria is rendered harmless in 24 hours, cholera bacilli are killed in 3 hours, whilst typhoid bacilli require 6 hours. Even after 15 minutes, sodium peroxide stops development, and water so treated can, therefore, probably be taken with impunity at the expiration of this time. With regard to the expense, 100 grms. of sodium peroxide cost M. 1.60, and the same weight of citric acid costs M. 0.50, so that the cost of the materials for disinfecting a litre amounts to not quite 3 Pf. Water so disinfected is tasteless and odourless, and in no sense prejudicial to health.
—T. A. L.

Denitrifying Bacteria, The Reducing Action of. G. Ampola and C. Ulpiani. Gaz. chim. ital. **29**, [1], 49—72 ; Chem. Centr. 1899, **1**, [16], 941.

The authors divide denitrifying agents into three classes :—(1.) Bacteria which decompose nitrites but not nitrates : *B. denitrificans* I. of Burri and Stutzer. (2.) Bacteria which decompose nitrates, but not nitrites.—*B. pyocyaneus* and *B. denitrificans* V. (3.) Bacteria which attack both nitrites and nitrates—all the remaining denitrifying bacteria. The nitrates of lithium, ammonium, sodium, potassium, rubidium, caesium, beryllium, magnesium, calcium, strontium, and barium are decomposed by the bacteria, but not the nitrates of silver, thorium, yttrium, iron, and manganese, nor even the most dilute nitric acid, whilst in the case of aluminium nitrate the action is doubtful. The nitrates of the lighter metals appear to be decomposed more easily than those of the heavier. On attempting to reduce other compounds by the aid of the bacteria, it was found that they did not develop at all in chromates, and only sparingly in bromates and iodates. Chlorates, arseniates, and ferricyanides are reduced by the bacteria, but not sulphates, phosphates, and molybdates.—A. S.

PATENTS.

Sewage, Impts. in the Treatment of. F. M. Spence and D. D. Spence, Manchester. Eng. Pat. 11,463, May 20, 1898.

This process, an extension of that described in Eng. Pat. 3450, 1898 (this Journal, 1899, 390), applies only to sewage which is sufficiently alkaline to decompose more aluminoferric than is necessary to precipitate the impurities. When such sewage is treated with aluminoferric and sulphuric acid in proportions sufficient to render the liquid neutral to methyl orange, the fatty matter is completely precipitated with the sludge, and the clear bright effluent can be applied to land in large quantities without fear of clogging or choking it up. As this effluent contains sufficient nitrogenous constituents "to bring its potential value at present prices for sulphate of ammonia, to about 9*l.* per million gallons," an additional inducement is offered (besides the value of the recovered fat and defatted solid manure) to utilise the sewage, "instead of virtually destroying it by bacterial processes."—L. A.

Sewage, Impts. in the Treatment of. F. M. Spence and D. D. Spence, Manchester. Eng. Pat. 11,574, May 23, 1898.

This invention is essentially similar to that described in Eng. Pats. 3450 and 11,463 of 1898 (see preceding abstract), except that ferric sulphate may be used instead of aluminoferric. The ferric sulphate is added to the sewage, together with sufficient sulphuric acid to render the liquid neutral to methyl orange, and the sludge containing all the fatty matter of the sewage is dried and treated with solvents, to recover the fat. The residual dry sludge is used as manure, and the clear effluent is irrigated on land.—L. A.

Sludge or Sewage Tanks, Impts in. R. Wilder, J. Wilder, and H. Wilder, Wallingford, Berkshire. Eng. Pat. 12,489, June 3, 1898.

Sewage is caused to flow through a series of precipitation tanks (which may be formed by dividing one long tank into a series of compartments). The fluid fills each tank in succession and overflows into the next tank through a filter made of open or basket work filled with coke breeze or other suitable material. Settling takes place in each tank, and an effluent is finally obtained which is clearer than when ordinary tanks are used.—L. A.

Sewage, Water, or other Liquids; Impts. in connection with Filter Beds for Filtering. R. O. Wynne-Roberts, Oswestry, Salop. Eng. Pat. 13,697, June 20, 1898.

The improvements consist of mechanism actuated by the effluent water from filter beds, by means of which the filter beds are automatically filled and emptied in rotation.—L. A.

(*C.*)—DISINFECTANTS.

Iodothymoform. Pharm. Post. **31**, 549; Pharm. J. 1899, **62**, [1504], 360.

A new disinfectant, to which the name iodothymoform has been given, is prepared in the following manner:—100 parts of thymol are warmed with 100 parts of formaline, the mixture well stirred for some time, then 100 parts of hydrochloric acid are added, when a violent reaction occurs, and a thick oily fluid separates, which on cooling solidifies. The solid mass is crushed, drained, washed, and dried. 41·6 parts of the dry product are dissolved in 50 parts of alcohol, together with 12 parts of potassium iodide and 32·8 parts of iodine, the mixture heated for one hour under a reflux condenser, then cooled, and a slight excess of ammonia added, when the iodothymoform separates out, and is collected, washed, and dried.—A. S.

Drinking Water, Sodium Peroxide as a Disinfectant for. F. Blatz. Apoth.-Zeit. **13**, 1898, 728.

See under XVIII. B., *page* 601.

Formaldehyde, Method for the Determination of. O. Blank and H. Finkenbeiner. Pharm. Zeit. 1899, **44**, 91; Chem. Zeit. 1899, 1.

See under XXIII., *page* 614.

XIX.—PAPER, PASTEBOARD, Etc.

PATENTS.

Paper Pulp and like Materials, Impts. in Apparatus for Straining. H. and P. H. Sanguinetti, London. Eng. Pat. 9682, April 27, 1898.

The present specification deals with improvements in the apparatus of Roeckner, Eng. Pats. 7932 of 1885 and 9126 of 1892 (see this Journal, 1893, 461). The inventors claim the method of construction of the strainer tubes or cylinders in sections which, together with the connecting parts, may be readily separable. The bearing parts of the axis are arranged outside the vat, and a removable portion is affixed to the delivery end of the vat. A special device for applying and securing rubber sleeves to make liquid-tight joints between the relatively reciprocating parts of the apparatus is claimed. Finally, the construction of pulp-straining apparatus, so that a part or parts of the strainer, its fan or divisions or the rubbers of the joints, may be removed or replaced without removing the heavy accessory parts of the machine, is specified.—J. F. B.

Celluloid, Improved Manufacture of. C. G. Hagemann and F. O. C. Zimmermann, Ludwigshafen, Germany. Eng. Pat. 11,456, May 20, 1898.

The inventors claim the manufacture of a new kind of celluloid by precipitating metallic hydrated or non-hydrated oxides from concentrated solutions of the respective salts whilst they are in intimate mixture with solutions of nitrocellulose, and then lixiviating the mass with water. The crude celluloid is then gelatinised by means of a solvent, with or without addition of camphor, and moulded into shape. The improved celluloid, as manufactured by precipitation of metallic oxides in molecular contact with the nitrocellulose, is only slightly inflammable. A special claim relates to the precipitation of hydrated alumina by kneading a solution of aluminium sulphate with nitrocellulose and acetone and adding concentrated caustic soda. After washing, camphor and castor oil may be added if desired.—J. F. B.

Nitrocellulose Products, Uninflammable. L. L. Bethisy, Paris. Eng. Pat. 11,927, May 25, 1898.

The manufacture of the products claimed, consists of five operations: (1.) Nitration of the cellulose, the nitrocellulose being centrifugalised till it contains 50 per cent. of acid, and then steeped in fuming sulphuric acid. (2.) Pulping, washing, and bleaching with potassium permanganate, the finished pyroxylin containing 50 per cent. of water. (3.) Partial desiccation and grinding; the grinding is done in cone mills in three stages, with the introduction of 10—15 per cent. of camphor or naphthalene at the first stage, dried albumin and powdered mica, or alum and asbestos at the second stage, and colouring matter at the third stage. (4.) The ground mass is pressed into thin cakes and moistened with 20 per cent. of alcohol and 10 per cent. of a paste of the following composition:—Any essential oil having a camphorated base and vaseline oil dissolved in acetic ether with the addition of 20—50 per cent. of solution of chloride of zinc at 45° B. and 5—10 per cent. of white gelatin. (5.) Solidification of the collodion as obtained in operation (4), by kneading it at 60° C., and then pressing as with ordinary celluloid.—J. F. B.

Insulating Material [Paper Pulp, &c.] for Electric Cables, Impts. in the Manufacture of. G. E. Heyl-Dia, Manchester. Eng. Pat. 2610, Feb. 6, 1899.

To any form of paper pulp are added non-hygroscopic oils, or liquors containing resins or pitches free from constitutional water, of non-conducting character, and in such quantities as when mixed with the pulp to become thoroughly incorporated therewith, so forming a perfect insulating material as aforesaid.—F. H. L.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Cerium, A Crystalline Double Carbonate of Peroxide of. A. Job. Comptes Rend. 1899, **128**, [18], 1098—1099.

The author allowed the stable, red-coloured solution, obtained by the action of hydrogen peroxide on cerium salts, in presence of potassium carbonate (see this Journal, 1899, 293), to evaporate spontaneously at the ordinary temperature. A quantity of blood-red crystals were thus obtained, belonging to the triclinic system, and often attaining a length of 0·5 cm. These crystals had the composition corresponding to the formula—

$$Ce_2O_3(CO_3)_3.4K_2CO_3.12H_2O,$$

a double carbonate of potassium and cerium peroxide. They give off carbon dioxide and oxygen on treatment with dilute acid, and lose their water of crystallisation at 110° C. without decomposition. After several hours at 200° C. they still retain their peroxide character, but at 230° C. a gradual evolution of oxygen takes place, followed at about 300° C. by evolution of carbon dioxide. It is a remarkable fact that the same compound is formed by the spontaneous peroxidation of cerous nitrate by shaking with potassium carbonate in presence of air without hydrogen peroxide.—J. F. B.

Glycerophosphoric Acid, Notes on. J. Cavalier and Pouget. Bull. Soc. Chim. 1899, **21**, [8], 364—366.

Pelouze having shown that the glycerophosphates of the alkaline-earth metals are less soluble in hot than in cold water, and are precipitated from a saturated solution on boiling, the authors have made experiments to determine the solubility of calcium glycerophosphate in water at different temperatures. According to their results, it appears that 100 grms. of the solution contain the following quantities of the anhydrous salt at the temperatures mentioned:—16° C., 7·9 grms.; 36° C., 4·4 grms.; 51° C., 2·3 grms.; 77° C., 1·3 grm.; 86° C., 1·25 grm.; and 100° C., 1·15 grm.

The precipitate deposited on heating the solution, is crystalline when it is formed slowly from a not too concentrated solution. It can be readily filtered and washed, and is completely soluble in water. The stability of the salt in solution resembles that of ethyl- and methyl-phosphates. The authors consider that calcium glycerophosphate can be purified by heating its aqueous solution to 60° or 70° C., and that little is gained by boiling the liquid. They prefer this method of purification to precipitating the salt with alcohol.

Barium glycerophosphate behaves differently, and its solutions are readily decomposed by heat. Hence the method of purification by boiling the liquid is not suitable for the barium salt, and it is preferable to separate it by means of alcohol.

The method described by Cavalier (this Journal, 1898, 877) for the volumetric determination of esters of phosphoric acid in the presence of phosphoric acid is also applicable to the determination of glycerophosphoric acid when mixed with phosphoric acid. Barium hydroxide solution is run into the mixture until the colour of Methyl-orange is changed in the cold. The liquid is then heated, and the titration finished with phenolphthaleïn as indicator.

The insoluble hydrogen barium phosphate is filtered off, and the hot filtrate should be sufficiently dilute to retain the barium glycerophosphate in solution.

Experiments made to determine the rapidity with which glycerophosphoric acid is decomposed by water at a temperature of 88° C., showed that in an aqueous decinormal solution, 0·0058 grm. of the acid is decomposed in an hour, and that the rapidity of decomposition increases with the temperature.

The results obtained with other esters of phosphoric acid under the same conditions of temperature and concentration were:—

		Grm.
Monomethyl-phosphoric acid ..	$PO_4(CH_3)H_2$	0·0056
Mono-ethyl-phosphoric acid....	$PO_4(C_2H_5)H_2$	0·0032
Mono-allyl-phosphoric acid.....	$PO_4(C_3H_5)H_2$	0·0055

—C. A. M.

Acroleïn, The Preparation of. A. Wohl and L. Neuberg. Ber. 1899, **32**, [8], 1352—1354.

Acroleïn may be readily prepared in quantity by the following method:—In a metal retort of about 3 litres capacity, ½ kilo. of glycerin and ⅓ kilo. of crystallised boric acid are heated until steam ceases to be given off and the mass begins to blacken. Some glycerin and boric acid come off with the steam, but no acroleïn; a very high temperature is required to decompose the intermediate glycerin-boric acid compound. After cooling, the retort is closed, surrounded with asbestos paper, connected to the condenser, and heated by means of powerful burners. The reaction is ended in 45 minutes, with a yield of 50 per cent. of the theoretical. If the distillation be slow in consequence of too low a temperature, the condenser may be easily stopped up by solidification of the boric acid carried over. To purify the distillate, it is distilled once alone and twice over calcium chloride.—A. C. W.

Datura Alba, The Alkaloids of. O. Hesse. Sudd. Apoth. Zeit. 1899, 2; Pharm. J. 1899, **62**, [1505], 383.

The author obtained from the air-dried flowers of *Datura alba* from China, 0·51 per cent. of hyoscine, 0·03 per cent. of hyoscyamine, and 0·01 per cent. of atropine. The hyoscine, $C_{17}H_{21}NO_4$, is amorphous, and easily soluble in cold water. It is similar in composition to the hyoscine obtained from henbane; but it is not identical with the scopolamine of Schmidt, since it is not acted upon by potassium carbonate, and does not yield atrosine when treated with moist silver oxide and dilute soda solution.

—A. S.

Laurotetanine. J. D. Fillipo. Archiv. **236**, 601; Pharm. J. 1899, **62**, [1505], 383.

The author has isolated the alkaloid laurotetanine, $C_{19}H_{25}NO_5$, from the bark of *Tetranthera citrata*, which has been shown by Holmes (Pharm. J. **23**, [3], 846) to be identical with *Daphnidium cubeba*. It is stated that the amorphous alkaloid obtained from the fruit of the plant by Braithwaite and Farr (Pharm. J. **17**, [3], 231) is probably impure laurotetanine. This alkaloid occurs to the extent of 0·25 per cent. in the bark. When pure, it crystallises in needles, melting at 134° C., which form crystalline halogen salts. The constitution of the alkaloid is probably $C_{16}H_{11}(OCH_3)_3(OH)_2.NH$. Physiologically, laurotetanine acts like strychnine, but is less toxic.—A. S.

Ipecacuanha Cultivation in India, Note on. D. Hooper. Pharm. J. 1899, **62**, [1505], 384.

The author has examined the influence of phosphatic manure on the growth of the ipecacuanha (*Psychotria ipecacuanha*), more especially with regard to the root, which is the most valuable portion of the plant. Young cuttings of an average height of about 6 inches were planted in four boxes, of which No. 1 contained an admixture of calcium superphosphate; No. 2, powdered phosphate from Trichinopoly; No. 3, dried cattle manure; whilst No. 4 contained the natural soil. The plants were completely uprooted after two years; and the three largest plants in each box examined. The height of the plants was found to have increased uniformly, irrespective of manuring. The roots were then separated from the stems, washed free from adherent soil, thoroughly air dried, and weighed. The results were as follows:—

	Grms.
Grown with addition of superphosphate, the average root weighed	5·6
Grown with addition of powdered phosphate, the average root weighed	5·3
Grown with addition of cattle manure, the average root weighed..	5·3
Grown with ordinary soil, the average root weighed...	2·6

—A. S.

Coumarin, Solubility of. Schimmel's Semi-Annual Report. Leipzic, April 1899, 66—67.

The following table indicates the solubilities of coumarin in alcohol of various strengths at different temperatures :—

100 Parts of Alcohol	At 0° C.	At 16° to 17° C.	At 29° to 30° C.
	Parts.	Parts.	Parts.
Of 90 vols. per cent. dissolve....	7·1	13·7	42·5
„ 80 „ „ „	6·0	12·3	38·3
„ 70 „ „ „	4·4	9·1	26·0
„ 60 „ „ „	3·2	6·0	16·0
„ 50 „ „ „	1·7	3·4	8·9
„ 40 „ „ „	0·7	1·5	3·9
„ 30 „ „ „	0·3	0·6	1·7
„ 20 „ „ „	0·2	0·4	0·8
„ 10 „ „ „	0·15	0·25	0·5
100 parts of water dissolve.....	0·12	0·18	0·27

In order to prevent coumarin from separating out from its solutions through fall of temperature, saturated solutions should be avoided ; coumarin may advantageously be used to replace Tonka beans where the tincture of the latter is used, 16 grms. of coumarin being equivalent to 1,000 grms. of beans.—J. O. B.

Estragol, The Occurrence of, in the Essential Oil of Chervil (Chærophyllum Sativum). E. Charabot and L. Pillet. Bull. Soc. Chim. 1899, **21**, [8], 368—370.

Estragol, the isomer of anethol, was first found in tarragon ("estragon") oil by Grimaux (Comptes Rend. **117**, 1189), and has since then been found by different observers in the essences of *persea gratissima, myricia acris,* anise and basil.

The authors have obtained from 36 kilos. of the fresh seeds of *chærophyllum sativum*, one of the *umbelliferæ*, 4·25 grms. of a clear yellow essential oil, the odour of which recalled that of anise and tarragon. On standing, a few crystals separated on the surface, but did not increase much on cooling the liquid with ice. They were proved to consist of a paraffin analogous to those which have been found in a number of essential oils. The main constituent of the oil was found to be estragol (paramethoxyallylbenzene), which was identified by converting it into anethol (paramethoxypropenyl benzene), and oxidising this to anisic aldehyde.

The authors point out that their investigation adds another to the long list of essential oils containing phenols or phenol esters with side allyl chains $R-CH_2-CH = CH_2$. These are met with much more frequently in essential oils than are the isomeric compounds with side propenyl chains :—$R-CH = CH-CH_3$, of which the only representatives known to occur naturally are anethol (iso-estragol) and probably asarone. Among the allyl derivatives found in natural essences are : Chavicol, estragol, eugenol, methyleugenol, ethyl-eugenol, betelphenol, safrol, and apiol.
—C. A. M.

Vanillin, Sophisticated. Schimmel's Semi-Annual Report. Leipsic, April 1899, 68.

Attention has previously been drawn to the adulteration of vanillin with acetanilide. Another adulterant is now reported, a sample offered in Austria, being found to contain 35·26 per cent. of acetyl isoeugenol.—J. O. B.

Neroli Oil (Oil of Orange Flowers), An Important Constituent of. H. Walbaum. Journ. für prakt. Chem. 1899, **59**, [6—7], 350—352.

The author finds that the methyl ester of anthranilic acid occurs in neroli oil, to the extent of 1·3 per cent., and from its properties, forms an important constituent of that oil. The base was obtained by shaking out neroli oil with 30 per cent. sulphuric acid, and saturating the acid solutions with soda.

The oily base thus obtained has a peculiar narcotic odour, and forms well crystallised simple and double salts. The purified dried sulphate gave analytical figures in accord with the formula $C_8H_9NO_2 . H_2SO_4$, and the pure base, liberated both from this sulphate, and also from the platinum double salt, agreed with the formula $C_8H_9NO_2$ and was found to contain one methoxyl group. It occurs as a colourless oil, which eventually crystallises ; it then melts at 25·5° C. The crystals and their solutions exhibit a blue fluorescence. It is sparingly soluble in water, but readily so in alcohol and in ether. It boils at 132° C. at 14 m.m, and has a specific gravity 1·168 at 15° C. The odour of the undiluted body, if not pleasant, is very characteristic. When diluted, the odour is that of neroli oil.

The same body was isolated from the oil obtained from orange blossoms preserved in salt, and was met with in other oils of similar origin. Details of the identification of the body are given, and the synthetically prepared methyl-ester of anthranilic acid is shown to possess the same physical and chemical characters as that obtained from the natural oil.—J. O. B.

Neroli Oil. E. and H. Erdmann. Ber. 1899, **32**, [8], 1213—1219.

The fraction of the essential oil of orange flowers boiling at 115° C., under 10 mm. pressure, was found to yield, on saponification, a crystalline acid, which was identified as anthranilic acid (*o*-amidobenzoic acid). This acid is contained in the oil in the form of its methyl ester, which was extracted as follows :—The oil of orange flowers was distilled under reduced pressure (12 mm.) until the vapours passing over indicated the temperature of 115° C. The residue was then taken, and, disregarding the separating out of about 15—18 per cent. of a paraffinoid substance, it was distilled in a current of steam. The distillate thus obtained was now extracted with ether, and into the ethereal solution, well dried by calcium chloride, dry hydrochloric acid gas was passed. The liquid, on standing, deposited crystals, which were filtered off, washed with ether, dissolved in water, and the solution distilled with addition of some sodium carbonate. The oil passing over possesses the odour of neroli oil, and crystallises on cooling. It is the methyl ester of anthranilic acid. Methyl anthranilate has not previously been obtained in the pure state. It is readily prepared by saturating a solution of the anthranilic acid in methyl alcohol with hydrochloric acid gas, boiling for one hour under the reflux condenser, decomposing the ester salt with soda and distilling in a current of steam. This is recommended as a commercial process. The ester forms large crystals melting at 24·5° C. and boiling at 127° C. under 11 mm. pressure, it is readily soluble in dilute mineral acids and organic solvents, and in water to a not inconsiderable extent. The hydrochloride melts at 178° C. The crystals of the ester and their solutions in ether and oils, have a blue fluorescence. The fluorescence of the orange-flower oils must be due to the presence of this ester. The ester has the specific neroli odour, but the odour of the ethyl ester is, as regards delicacy, not to be compared with it. The methyl ester may be readily identified by means of its benzoyl compound, which crystallises from hot alcohol in long white needles melting at 99°—100° C., and is obtained by the action of benzoyl chloride upon the ester.

The lowest boiling fraction of one of the neroli oils gave a weak pyrrol reaction, but this could not be obtained from the most carefully prepared oils. From an orange oil from unripe fruits by repeated distillation a fraction was obtained boiling at 166—169° C. under ordinary pressure, which was rich in pyrrol derivatives ; it appeared to contain an *N*-alkyl pyrrol.—A. C. W.

Oil of Cade, Further Investigation of. Cathelineau and Hausser. Bull. Soc. Chim. 1899, **21**, [8], 378—380.

In the separation of cade oil into two classes of compounds by means of a 5 per cent. solution of potassium hydroxide (this Journal, 1898, 868), the soluble substances were extracted with petroleum spirit and with amylic alcohol. The fraction removed by the latter solvent is a resinous substance, which, on treatment with water, can be divided into a soluble and insoluble portion.

The insoluble portion is a resinous body which becomes pasty on heating, and fuses in hot water without dissolving.

It is soluble in chloroform, and concentrated acetic acid, and incompletely soluble in ether. It reduces ammoniacal silver nitrate, but is without action on Fehling's solution. It is precipitated from an alcoholic solution by normal lead acetate. On fusion with potassium hydroxide, it is converted into a resinous substance, insoluble in water, and an alkaline soluble portion. On acidifying this solution a semi-liquid precipitate is obtained, and the filtrate from this contains small quantities of resorcinol and pyrogallol, which can be extracted with ether.

The soluble portion of the original fraction has a slightly alkaline reaction, and contains sodium compounds of organic bodies which can be precipitated by acids. The precipitate thus obtained is a soft substance, semi-liquid at the ordinary temperature, very soluble in alcohol, and insoluble in water, ether, and petroleum spirit. Its density is greater than that of water. It can be separated into two fractions by distillation *in vacuo*. A resin is left, whilst water and a phenol-like body pass over. The latter, which distils under ordinary pressure between 215° and 250° C., has an odour of creosote.

From this the authors conclude that the fraction of cade oil extracted by the amylic alcohol is composed for the most part of phenol esters of resinous bodies.—C. A. M.

Juniper Wood Oil. E. J. Parry. Chem. and Druggist, **54,** 690.

THE so-called "juniper wood oil" of commerce is not obtained by the distillation of the wood of *Juniperus communis,* but is either turpentine distilled over juniper berries, or the twigs and berries, or is simply a mixture of pure juniper oil and turpentine, or else consists of the terpenes obtained as by-products in the preparation of the "concentrated" oil. Observation of the specific gravity and optical rotation are not in themselves sufficient to establish the purity of juniper oil, since these may be adjusted by the mixture of lævo- and dextro-turpentines to fall within the official requirements. An appreciable fraction boiling between 285° and 290° C. should be present, pure juniper oil yielding from 12 to 16 per cent. between those temperatures. Juniper wood yields only a small quantity of volatile oil, which never comes into commerce.—J. O. B.

Alpinia Malaccensis, Essential Oil of. Schimmel's Semi-Annual Report, Leipsic, April 1899, 46.

THE essential oil from the rhizomes of *Alpinia malaccensis* belonging to the N. O. Zingiberaceæ, locally known in the vernacular as "Ladja goah," was distilled in the Government laboratory in the Botanical Gardens at Buitenzorg. The oil, which is present to the extent of 0·25 per cent., has a pleasant odour of methyl cinnamate with a suggestion of borneol. When slightly cooled, it solidifies, due to the crystallisation of this cinnamate, which is now recorded for the first time as a constituent of an essential oil. At 27° C. the oil is liquid and has a sp. gr. of 1·030 to 1·047; it is slightly dextrogyrate, 0·25° to 1·5° in 200 mm. The leaves of the plant also yielded an oil rich in methyl cinnamate. This ester will probably be found to be a constituent of other oils derived from plants of the same species. *Alpinia nutans* gives an oil which yields a fraction between 255° and 265° C., and, on saponification, yields an acid melting at 134° C., probably cinnamic acid.—J. O. B.

Camphor Oil, Technical Applications of the Higher Boiling Fractions of. Schimmel's Semi-Annual Report, Leipsic, April 1899, 8.

IN the manufacture of safrol, considerable quantities of the so-called heavy oil of camphor, having a specific gravity of 0·970 at 15° C. and boiling between 240° and 300° C., are obtained. This oil is light green in colour, and has the consistence of a fatty oil. It is not readily inflammable, and is a good solvent for resin and caoutchouc. It increases the elasticity of varnishes, without diminishing their drying properties. It is particularly adapted for use in common resin varnishes. It is also well adapted for masking the odour of mineral oils and carriage grease without interfering with their lubricating power. It is applicable in soap-making, particularly for soft soaps and for disguising the odour of strong smelling oils, such as bone oil, also for leather dressing, boot blacking, and other similar purposes.
—J. O. B.

Cognac Oil. Schimmel's Annual Report, Leipsic, April 1899, 15—16.

NO data for cognac oil being available, various samples were examined, with the following results :—

Origin.	Specific Gravity at 15°	Opt. Rot. at 20°	Acid Number.	Ester Number.	Solubility.
		° ′			
From the Rhine. Raw oil from wine lees.	0·878	– 0 3	55·2	207·3	Soluble in 2 vols. and more 80 per cent. alcohol.
The same, rectified	0·879	– 0 4	50·9	218·6	,, ,,
From Lausatia. Raw oil from wine lees	0·880	– 0 10	70·9	210·8	,, ,,
The same, rectified	0·880	– 0 11	68·6	140·9	,, ,,
Spanish	0·876	..	37·1	212·4	Insoluble in 80 per cent. alcohol, soluble in ½ vol. and more 90 per cent. alcohol.
Commercial	0·883	+ 0 43	105·5	172·8	Soluble in 2 vols. and more 80 per cent. alcohol.
Synthetic	0·871	± 0	5·8	291·7	Soluble in 10 vols. and more 70 per cent. alcohol.

It is evident from these figures that the synthetic oil is characterised by a low specific gravity, and a high ester number, physical characters which would reveal admixture, in large quantities, with the natural oil.—J. O. B.

Bismuth Peroxides. C. Deichler. Zeits. für Elektrochem. 1899, **5,** 517.

See under XXIV., *page* 616.

Benzoic Acid, Examination of Pure, for Adulteration with Artificial. P. N. Raikow. Oesterr. Chem. Zeit. **2,** 121; Chem. Centr. 1899, **1,** [18], 1043.

See under XXIII., *page* 612.

Eucalyptol, Scammell's Process for the Determination of. W. H. Allen. Chem. and Druggist, 1899, **54,** [1004], 641.

See under XXIII., *page* 614.

Ether, Detection and Estimation of Ethyl Alcohol in. Lassar-Cohn. Süddent. Apoth. Zeit. **38,** 251.

See under XXIII., *page* 614.

Alkali Periodates, Determination of. E. Péchard. Comptes Rend. 1899, **128,** [18], 1101.

See under XXIII., *page* 609.

Alkaloids, Estimation of, with Iodine Solution. M. Scholtz. Zeits. and Chem. 1899, **38,** [4], 226.

See under XXIII., *page* 614.

Alkaloids, Estimation of, with Iodine Solution. C. Kippenberger. Zeits. Anal. Chem. 1899, **38,** [4], 230.

See under XXIII., *page* 615.

Solanine, Telluric Acid as a Reagent for. Bauer. Zeits. für angew. Chem. 1899, 99.

See under XXIII., *page* 612.

PATENTS.

Ozone, Impts. in Apparatus [Portable] for Producing. M. Otto, Neuilly-sur-Seine, France. Eng. Pat. 17,260, Aug. 10, 1898.

See under XI. A, *page* 589.

Mercury or Amalgam, An Improved Process for Finely Dividing. A. N. Blomquist, Stockholm. Eng. Pat. 4712, March 3, 1899.

In the manufacture of mercury preparations, the mercury is finely divided in the form of an amalgam, by having mixed with it, whilst being stirred, either magnesium or aluminium, or both, and a small quantity of caustic potash or soda. The whole is heated to boiling point to form the amalgam, which can be finely divided by grinding. The proportions may be mercury 97 parts, magnesium 2 parts, and aluminium 1 part. Lithium or other earth metals, either separately or mixed together, may be also added, or they may be substituted for the magnesium or aluminium.

—A. W.

Nicotine, Impts. in the Manufacture or Obtainment of. R. Mackill, Glasgow. Eng. Pat. 5747, March 9, 1898.

The process claimed consists in the agitation of tobacco extract with caustic soda, extraction of the liberated nicotine by light petroleum spirit, and distillation of the solvent. A suitable apparatus is described and claimed.—A. C. W.

Methenyldi-p- and o-Phenetidine and Anisidine, The Manufacture of. C. Goldschmidt, Frankfort-on-the-Maine, Germany. Eng. Pat. 9792, April 28, 1898.

The patentee claims the manufacture of compounds of orthoformic ester with *o*- and *p*-phenetidine and anisidine, for use as anæsthetics. Condensation is effected by heating in alcoholic solution on the water-bath and pouring into dilute soda solution—

$$2NH_2.C_6H_4.OC_2H_5 + CH(OC_2H_5)_3 =$$
$$C_2H_5O.C_6H_4.N:CH.NH.C_6H_4.OC_2H_5 + 3C_2H_6O.$$

—A. C. W.

Camphoric Ethers of the Pyrocatechinmono-alkyl Ethers, The Manufacture and Production of. G. W. Johnson, London. From Kalle and Co., Biebrich-on-Rhine, Germany. Eng. Pat. 10,433, May 6, 1898.

The process claimed, consists in heating the pyrocatechol mono-alkyl ether (guaiacol) with camphoric acid in the presence of a condensing agent (phosphorus oxychloride), and separating the acid ester by washing with sodium carbonate solution.—A. C. W.

Sulphur Compounds of Mineral Oils and similar Hydrocarbons, Impts. in and relating to. L. O. Helmers, Hamburg. Eng. Pat. 10,875, May 12, 1898.

The sulphonated compound obtained by the action of sulphuric acid on Seefeld mineral oil, and known as "ichthyol," is accompanied by a volatile oil possessing a disagreeable odour. The patentee finds that by the action of oxidising agents, these products are attacked before the ichthyol, and may in this way be removed, leaving the ichthyol odourless or nearly so. For example, 10 kilos. of ichthyol-ammonium and 7·5 litres of water are mixed with 2·5 kilos. of hydrogen peroxide (3 per cent. solution), and allowed to stand in the cold. After 24—48 hours the mixture is concentrated, the residue dissolved in water, neutralised with ammonia, and evaporated to 10 kilos.

—T. A. L.

Birch Bark, Manufacture or Production of certain Substances from. J. Wheeler, Ilfracombe. Eng. Pat. 13,283, June 14, 1898.

By burning birch bark, or material made from birch bark containing betulin, in a closed chamber, without flame, and in currents of air, certain substances, which are termed pyrobetulin and pyrobetulin anhydride, are produced in forms other than that of films.—J. G. P.

Salicylic Acid, Preparations suitable for Surgical Antiseptic Purposes, The Manufacture and Production of. B. Willcox, London. From The Vereinigte Chininfabriken Zimmer and Co., Frankfort-on-Maine, Germany. Eng. Pat. 13,459, June 16, 1898.

Salicylates of the rare earth metals, especially didymium and lanthanum, are obtained by precipitation or by the action of the acid on the metallic hydrate or carbonate.—A. C. W.

Acetylleucomethylene Blue, and of Acetylleuco-ethylene Blue [Medicament], Manufacture of. O. Imray, London. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 13,724, June 20, 1898.

The tinctorial powers of Methylene Blue form an obstacle to its employment for medicinal purposes. This is not the case with the acetyl compound, which can be obtained as follows:—A mixture of 25 kilos. of glacial acetic acid and 75 kilos. of acetic anhydride is poured on to 25 kilos. of Methylene Blue, and gradually reduced by adding 25 kilos. of zinc dust. The whole is then boiled for 1—2 hours, and the reaction product is precipitated by adding water. Acetylleucomethylene Blue separates from hot glacial acetic acid in groups of hard needles, melting at 181° C. It is tasteless, and liberates Methylene Blue in the organism. The picrate forms greenish-brown laminæ, melting at 183° C. The addition of ferric chloride to a hydrochloric acid solution gives a precipitate of fine greenish metallic needles. Acetylleuco-ethylene Blue melts at 180° C., and gives a similar picrate to its lower homologue.—T. A. L.

Methylmorphine [Codeine] and Ethylmorphine, A Process for the Production of. A. Ehrenberg, Darmstadt, Germany. Eng. Pat. 14,465, June 30, 1898.

The patentee claims the process, which consists in heating morphine in alcoholic solution on the water-bath with alkalis or alcoholates and normal methyl or ethyl sulphate.

—A. C. W.

Hydroxymethylene-uric Acids, Impts. in the Manufacture or Preparation of Alkyl Derivatives of. G. W. Johnson, London. From C. F. Boehringer and Soehne, Waldhof, Mannheim, Germany. Eng. Pat. 3300, Feb. 14, 1899.

The preparation of alkyl derivatives of hydroxymethylene-uric acids by agitating the alkaline solution of the acid with a haloid ester, filtering off the alkyluric acid which separates on cooling, and evaporating, is claimed.—A. C. W.

Insoluble Phenolic Compounds free from Taste and Smell, Process for Producing. H. S. Jones. From J. Brissonnot, Paris. Eng. Pat. 5650, March 15, 1899.

Phenolic bodies, such as wood-creosote and guaiacol, and their admixtures with tannin, are treated with methyl aldehyde and hydrochloric acid. The product is then washed with boiling water. The process and products are claimed.—A. C. W.

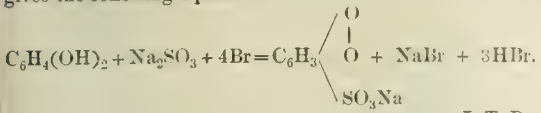
XXI.—PHOTOGRAPHY.

Latent Photographic Image, Theory of the Development of. Andresen. Bull. Soc. Franç. Phot. 1898, 395 (Monit. Scient. 1899, [4], **13**, 164—166).

Relative Power of Developers.—To measure this, quantities of various developers derivable from 1 grm. of benzene were dissolved in water, with addition of alkali sulphate and carbonate, and allowed to act in the dark on freshly precipitated silver bromide in excess, for 20 minutes. The remaining developer was then destroyed, and the amount of reduced silver determined. In the case of developers needing the addition of caustic alkali, this was added instead of carbonate. The results are of course of relative value only. The following results show how much more powerful the para-compounds are than the corresponding ortho-compounds:—Catechol, 4·62; hydroquinone, 10·46; ortho-amidophenol, 1·74; paramidophenol, 9·36; methylortho-amidophenol, 5·9.

Action of Alkali Sulphite.—Comparative experiments with paramidophenol hydrochloride, in one of which alkali carbonate alone, in the other alkali carbonate and sulphite, were added, showed by a violet coloration and reduction of 2·4 grms. of silver in the first case, against a reduction of 9·36 grms. in the second, that the sulphite enters into the reaction, which proceeds quite differently without it.

Results of the Action.—In the case of hydroquinone, the products of the action were determined, and a sulphonic acid of quinone was found to be produced. The author gives the following equation :—



$$C_6H_4(OH)_2 + Na_2SO_3 + 4Br = C_6H_3 \begin{cases} O \\ \;| \\ O \\ SO_3Na \end{cases} + NaBr + 3HBr.$$

—J. T. D.

Developers, The Salts of Amines and Phenols as. A. and L. Lumière and Seyewetz. Bull. Soc. Franç. Phot. 1899, 31 ; Monit. Scient. 1899, [4], **13**, 162.

The salts of monamines do not act as developers : alkali must be added to them to set free the base. Even with diamines this is really the case, for the alkali sulphite which must be added to them sets free the base, forming at the same time bisulphite. Phenolic developers also act only after alkali has been added. The authors have studied the properties, as developers, of compounds of amines and phenols which they prepared. In the case of monamines, compounds of hydroquinone (quinol) with aniline, paratoluidine, and quinoline did not act as developers, even with addition of sodium sulphite, but required the addition of alkali, which of course broke them up into their constituents. In the case of diamines, compounds of para- and orthophenylene diamine with phenol or cresol were found to act as developers alone. Active diamines with active dihydric phenols (phenylene diamines with hydroquinone or catechol) were active alone ; compounds of active diamines with inactive dihydric phenols (phenylene diamines with resorcinol) were also active alone, but in a lower degree than the former class ; compounds of inactive diamines with active dihydric phenols (metaphenylene diamine with hydroquinone or catechol) were inactive, even with sulphite, and needed addition of alkali before they would develop ; even then their action was weaker than that of the active phenol without the diamine. Paraphenylene diamine with pyrogallol also gave a compound, but this was extremely slow and weak as a developer.—J. T. D.

Hydroquinone (Quinol) and Paraphenylene Diamine, A New Compound of, as a Developer. A. and L. Lumière and Seyewetz. Monit. Scient. 1899, **13**, 168—169.

Hydroquinone and paraphenylene diamine unite in molecular proportions to form brilliant white scales, melting at 194°—195° C. to a red-brown liquid, slightly soluble in cold, more so in hot water, slightly in alcohol, readily in acetone, acids, or alkalis. This compound is known as "Hydramine." The alkaline solution turns brown in the air, but sodium sulphite prevents this.

The aqueous solution, alone or with the addition of alkaline carbonates, sodium sulphite, or tribasic phosphate, or the solution in acetone, will act as developers, but are not practically useful, as they are either slow or give grey tones to the picture. Lithia in small quantity increases enormously the activity of the aqueous solution, and the authors give the following formula as the result of their experience :—Water, 1,000 c.c. ; sodium sulphite, 15 grms.; the Hydramine, 5 grms. ; lithium hydroxide, 3 grms. This solution can be kept indefinitely in a stoppered bottle. It gives sharp and yet graded images, is rapid, regular, and in time as intense in its effects as the most powerful developers ; moreover, it is extremely sensitive to the restraining influence of potassium bromide.—J. T. D.

Photogravure by Silver Salts. Warnerke. Bull. Assoc. Belge Phot. 1898 ; through Monit. Scient. 1899, **13**, 167.

A tough paper is covered with a film of very soluble gelatin, followed by two coatings of gelatino-chloride emulsion. The negative is blacked out round the edges as for carbon printing, and the prepared paper exposed under it (one to five seconds daylight, ten minutes gaslight). The print is now softened in water, and then developed. For developer, solutions are made of (*a*) water, 100 c.c. ; pyrogallol, 10 grms. ; citric acid, 1 grm. ; and (*b*) water, 100 c.c. ; liquor ammoniæ, 12 c.c. ; potassium bromide, 4 grms. ; and 10 drops of (*a*) and 14 drops of (*b*) are added to 45 c.c. of water. The tissue is then laid face downwards on a copper plate, and the water squeezed out from between them. The whole is placed in water at 30° C., and the paper lifted off as soon as the gelatin has dissolved. The copper plate and film are then placed in a mixture of equal volumes of alcohol and water to complete the development, taken out, and allowed to dry for at least 10 hours. The plate is then etched, with the usual precautions, by successive solutions of ferric chloride of densities 1·454, 1·425, 1·385, 1·346, giving 10 minutes' exposure to each, after which it is washed and cleaned in the usual way.—J. T. D.

Interference-Colour Plates, Preparation and Treatment of. G. Lippmann. Bull. Soc. Franç. de Phot. 1899, [2], **15**, 117.

To a 4 per cent. aqueous solution of gelatin are added 0·53 grm. of potassium bromide, 6 c.c. of a 2 per cent. alcoholic solution of Cyanine, and 3 c.c. of a 2 per cent. alcoholic solution of Quinoline Red. The mixture is cooled to 40° C., and in the dark room, 0·75 grm. of dry powdered silver nitrate is incorporated by agitation. The emulsion is filtered through glass-wool, the plates coated on a levelling table, and finally washed for half an hour. Just before exposure, they are sensitised by floating them with silver nitrate, 1 part ; glacial acetic acid, 1 part ; absolute alcohol, 200 parts ; allowing the excess to drain away. Exposure to bright sunlight occupies about two minutes. The developer is :—(*a*) pyrogallol, 1 ; water, 100 ; (*b*) potassium bromide, 10 ; water, 100 ; (*c*) ammonia, sp. gr. 0·960 ; for use :—(*a*) 10 c.c. ; (*b*) 15 c.c. ; (*c*) 5 c.c. ; water, 70 c.c. The fixing bath is dilute potassium cyanide.—F. H. L.

Over-Exposed Plates, Development of. P. Mercier. Bull. Soc. Franç. de Phot. ; through Phot. Rundsch. 1899, **13**, 89.

According to the author, if an ordinary dry plate, before or after exposure, be treated with a weak solution of one of the usual "developing" reagents, *e.g.*, amidol, metol, ortol, hydroquinone, or pyrogallol, it can be afterwards successfully developed, even if the correct exposure has been greatly exceeded. 0·01 grm. of amidol may be dissolved in 100 c.c. of water, the solution allowed to become brown in the air, and the plate immersed in the liquid for two minutes ; the film thus absorbs 1 grm. of the bath or 0·1 mgrm. of amidol. The plate may then be over-exposed 1,000 times, yet by means of a hydroquinone-sodium carbonate developer will give a negative of proper density for printing.—F. H. L.

Photographic Prints on Silk. Bull. Soc. Hav. Phot. 1898 ; through Monit. Scient. 1899, **13**, 167.

See under VI., *page* 581.

PATENTS.

Photographic Printing, Impts. in and connected with. T. Manly, London. Eng. Pat. 10,026, May 2, 1898.

To produce photographic pictures or images in pigment or in aniline or other colours, paper, in the first place, is coated with an aqueous solution of a bichromate and a manganese salt, to which some boric acid and aluminium sulphate are added. Exposed to light under a negative, the paper so prepared, gives a brown positive image in Mn_2O_3 or MnO_2, called by the inventor the "print." With this print a coloured picture may be made by either of the following methods. Carbon tissue (paper coated with pigmented gelatin) is dipped in a solution of hydroquinone in acetic acid, in the presence or absence of some ferrous sulphate. The washed print, after having been given a coating of a 2 per cent. solution of gelatin, is brought in contact with the surface of the carbon tissue under the acetic acid solution. They are squeezed together on a flat surface, and then hung up to dry. To develop an image in the pigmented gelatin, the print has to be developed in water at 43° C. Or the washed and dried print is coated with a hot solution of pigmented or coloured gelatin, dried, then dipped in above-mentioned acetic acid solution, hung up, dried again, and developed in water at 43°. If the print be dipped in a solution of 20 grms. of aniline hydrochloride, 2 c.c. of sulphuric acid, and 300 c.c. of water, a green image may be produced. With a weak solution of ammonia, the image turns purple, and if chloride or bromide of copper be added to the aniline solution, a dark-blue picture will be the result.—S. K.

Argentiferous Sensitive Surfaces, Preparation of, for Photographic Purposes; Impts. in. P. Mercier, Paris. Eng. Pat. 11,420, May 19, 1898.

The invention consists in rendering the film capable of bearing long exposure to light without being in the ordinary sense over-exposed thereby, and in being able thus to obtain good pictures when the exposure has been inaccurate. This is effected by adding to the emulsion of argentiferous salts the following substances, or by immersing the film, preferably before exposure though the effect is obtainable after exposure, in a solution of one of the substances. The substances in question are:—(A.) Antimony salts with a tartrate or citrate, such as tartar emetic, or salts of morphine, codeïne, or their derivatives. These are used in a 1—3 per cent. solution, the film being immersed for about two minutes, and afterwards dried. (B.) Substances such as hydroquinone, metol, ortol, amidol, pyrogallol, paramidophenol, catechol, resorcinol, glycine, &c., in solution containing about 0·1 grm. of the active substance and 1 or 2 grms. of acetic acid or sodium sulphite in 100 c.c.; or the same substances oxidised by exposure in alkaline solution to the air, in this case the solution containing not more than 0·01 grm. per 100 c.c. In all cases a slow developer should be used; a suitable formula is: Hydroquinone, 10 grms.; sodium sulphate and carbonate, 60 grms. each; potassium bromide, 5 grms.; water to make up a litre.—J. T. D.

Photographic Developer, Improved. J. Hauff, Feuerbach, Germany. Eng. Pat. 13,195, June 13, 1898.

The author uses the chlorine, bromine, or iodine substitution derivatives of hydroquinone, hydrotoluquinone, pyrocatechin, pyrogallol, or α- or β-hydronaphthoquinone. They develop very quickly and powerfully, and are not affected by temperature. A typical developer consists of: Water, 100 c.c.; monochlorhydroquinone, 1 grm.; crystallised sodium sulphite, 8 grms.; potash or calcined soda, 4 grms.; 10 per cent. potassium bromide, 10 to 20 drops.—J. T. D.

Developing and Fixing simultaneously a Latent Photographic Image, Process for. L. Ellon, Berlin. Eng. Pat. 4808, March 4, 1899.

A developing solution is made up of: Catechol, 7 grms.; potassium hydroxide, 6 grms.; crystallised sodium sulphite, 30 grms.; water, 75 grms. For a plate 13 by 18 cm., there are used: 10 c.c. of the developing solution, 20 c.c. of sodium hyposulphite solution 1 to 5, and 20 c.c. of water. In this, a plate exposed in the usual way gives in from three to five minutes a perfectly developed and fixed negative. By varying the dilution of the bath or the quantity of alkali, or by adding potassium bromide, it can be adapted to all degrees of exposure, and is applicable to films, bromide paper, or lantern plates.—J. T. D.

XXII.—EXPLOSIVES, MATCHES, Etc.

"Pyrodialite": Turpin's New Explosive. Chem. Zeit. Rep. 1899, **23**, [8], 70; from "Echo des Mines," Gluckauf, 1899, **35**, 126.

This explosive is prepared in two forms, with and without the production of flame. No. 0 and No. I. of the first group contain respectively 88 and 80 of potassium chlorate, 5 and 6 of vegetable charcoal, 10 and 18 of neutral gas tar, and 2 to 3 and 3 to 4 of ammonium or sodium bicarbonate; No. II. and No. III., 40 of potassium chlorate, 40 of sodium or potassium acetate, 5 of wood charcoal, 20 of tar, 4 to 5 and 4 of ammonium or sodium bicarbonate.

The liquid tar is treated with alkaline lye, washed, and drained. The oxidising substances and the charcoal are ground separately. The ingredients are mixed in a leather drum, first the oxygen carriers, then half the tar, and finally the charcoal, the remaining half of the tar and the alkali. The mass forms itself into fine grains.

The flameless varieties, for fiery mines, are made differently. First the oxidising materials, then the alkali and the substances for absorbing the heat produced during the explosion. The process may be carried out either in the dry or the wet way. Turpin found that chlorates and perchlorates dissolved with acetates, yield compounds or mixtures in which the acetate plays the part of combustible. One molecule of potassium chlorate and half a molecule of calcium acetate give, on crystallisation, a true detonating powder with small development of heat. These substances combined with bichromates give double oxidising materials. If, to a mixture of definite quantities of chlorate, charcoal, and tar, a substance capable of absorbing heat is added, a flameless explosive results. The composition of such explosives is 35 grms. of double acetochlorate of calcium or potassium, 45 of potassium chlorate, 5 of vegetable charcoal, 18 of gas tar, 15 of bicarbonate of ammonia or soda, or ammonium oxalate. Another is, 35 grms. of double chlorobichromate of potassium or ammonium, 10 of potassium, sodium or ammonium acetate, 15 of potassium chlorate, 15 of barium bicarbonate or oxalate, 5 of vegetable charcoal, and 18 of tar.—L. J. de W.

Dynamite and Gelatin Dynamite, Notes on the Analysis of. F. W. Smith. J. Amer. Chem. Soc. 1899, **21**, [5], 425.

See under XXIII., *page* 615.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Resazurine, Use of, in the Preparation of Standard Alkaline and Acid Solutions. A. Lemoine. Bull. Assoc. Belge des Chim. **13**, [4], 188—189.

Owing to its property of giving three colour reactions—an onion-red tinge in presence of free acid, a blue in presence of free alkali, and a violet-red (probably due to resorufine) when the solution is exactly neutral—the use of resazurine enables standard alkaline and acid solutions to be prepared of exactly equal values, whereas when litmus or phenolphthalein is employed as indicator, the alkaline solution has always—according to the Fresenius method—to be made the stronger (by 1 c.c. of concentrated solution) in order to produce the colour change at the end point of the titration. —C. S.

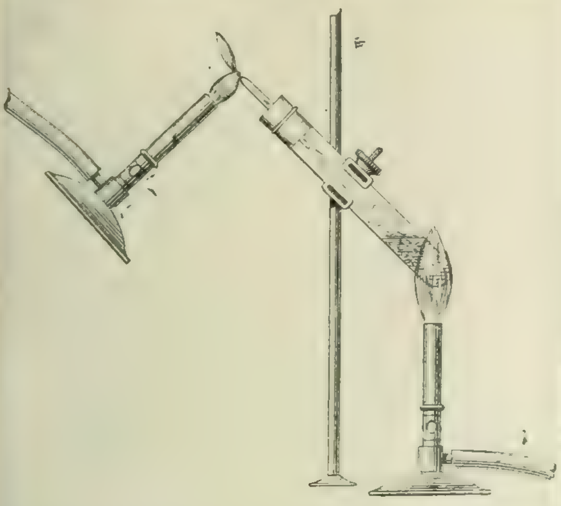
INORGANIC CHEMISTRY.—QUALITATIVE.

Boric Acid, Tests for. V. Lenher and J. S. C. Wells. J. Amer. Chem. Soc. 1899, **21**, [5], 417—420.

By means of the apparatus shown in the figure, the authors have adapted the device described by Newth ("Chem. Lecture Experiments," 227) to the detection of boric acid. A mixture of the borate, with concentrated sulphuric acid and alcohol is placed in a test tube fitted with a cork, through which passes a glass tube drawn out to a jet. The alcohol expelled from the tube on heating is burned at the jet in the flame of a second Bunsen burner. If boric acid be present the flame will have the characteristic green tint. By the usual method of applying the flame test, boric acid could be detected in a solution containing 0·01 grm. of boron trioxide in 1 c.c., whilst by the apparatus described, a faint green colour could be observed with a solution of one-tenth the strength. Copper and barium salts do not interfere.

A series of experiments was also made to determine the limits of sensibility of other tests for boric acid. In the glycerin test, a bead of potassium sulphate was ignited after being dipped in a solution of borax. When cool, it was dipped in glycerin and the latter ignited. If boric acid had been liberated by the ignition with potassium sulphate, the glycerin burned with a green flame.

In calculating the results tabulated below, account was taken of the fact that in the bead and turmeric-paper tests, the amount of boric acid actually taking part in the reaction was much less than that contained in 1 c.c. of the solution.



	Limit of Test.	B_2O_3 actually present in Test.	B_2O_3 in Solution.
	Grm.	Grm.	Per Cent.
Boric ether flame (old method)	0·01	0·01	1·0
„ „ (new method)	0·001	0·001	0·1
Glycerin test	0·001	0·00006	0·1
Potassium fluoride and potassium bisulphate test.	0·01	0·0006	1·0
Turmeric-paper test	0·0001	0·000013	0·01

—C. A. M.

Gold in Ores, Simple Methods for the Detection of. J. Ohly. Eng. and Mining J. 1899, **67**, [17], 499.

It is stated that the test depending on the formation of the purple of Cassius by dissolving the ore in acid and adding stannous chloride to the solution, is not reliable when only small quantities of gold are present. The following methods are stated to allow of the detection of 0·025 oz. of gold per ton, and are specially adapted for the separation of gold from sulphides, in which case, however, it is necessary to first roast the sulphide ore, the temperature being raised at the end to a full red heat. If the ore contain an excess of carbonate of lime, the roasted mineral should be gently re-ignited with ammonium carbonate, so as to prevent the entry of much lime into the solution to be tested.

(1.) About 4 oz. of the finely pulverised ore is well mixed with an equal volume of tincture of iodine, and the mixture allowed to stand for, at the most, an hour, with occasional agitation. After allowing to settle, a strip of Swedish filter paper is dipped into the clear solution, and then dried, the operation being repeated six times, to ensure thorough saturation of the paper. On burning the strip, the ash, in the presence of gold, will show a purple coloration, which is destroyed by the addition of bromine water.

(2.) About 4 oz. of the finely divided ore are covered with an equal volume of bromine water, the solution, after standing and agitating for an hour, is filtered, and the filtrate tested for gold by the addition of stannous chloride—formation of the purple of Cassius.—A. S.

Mercury, A Modification of Eschka's Test for. K. E. Chism. Berg- u. Hüttenm. Zeit. **58**, 149—150; Chem. Centr. 1899, **1**, [17], 996.

The Eschka gold-cover test for mercury gives very accurate results, but, owing to the use of gold, and to the rapid wasting of the gold cover, it is expensive. The author uses a cover of silver foil of 0·02 mm. thickness, which admits of being used three times, and costs 4 pf. per test. To cool the foil, a silver or copper crucible containing water is used, whilst, to prevent heating of the cover, the porcelain crucible is fixed in a plate. As flux, iron filings which will pass through a 60-mesh screen are used, after being washed with alcohol and heated to faint redness in a muffle.

In carrying out the test, 0·5—1 grm. of ore is mixed with 5 grms. of iron filings, the mixture covered with 1 grm. of filings, the crucible fixed in the plate, the weighed silver cover placed on, and on this the cooling crucible, and the whole heated 10—15 minutes with a spirit lamp. The cooling water may be renewed as required. With even the smallest quantities of mercury, the silver foil exhibits stains. On terminating the test, the silver cover is again weighed. It is made ready for use again by heating to volatilise the mercury.—A. S.

Bone Superphosphate, Methods for Detecting the Adulteration of, with other Superphosphates. F. Dupont. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [8], 767—771.

From among eleven methods proposed to solve this question the federation of Italian agricultural syndicates have approved that of H. Lasne, of Paris, which depends on a microscopical examination and chemical analysis.

The microscopical examination reveals the differences of structure (undulated, concretionary, crystalline, &c.) and the presence of vestiges of micro-organisms (diatoms, foraminifera, fragments of teeth), characteristic of many mineral phosphates.

From the results of chemical analysis the limits fixed for a bone superphosphate are 130 to 135 of lime per 100 of phosphoric acid. More than this would indicate addition of gypsum, mineral phosphates, or the residues of factories where gelatin is prepared from bones by treatment with acids —L. J. de W.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Sulphuric Acid, Determination of, in presence of Iron. C. Meineke. Zeits. anal. Chem. 1899, **38**, [4], 211—217.

If a soluble sulphate be precipitated with barium chloride in presence of much ferric salt, the barium sulphate obtained is found to contain an appreciable quantity of iron. To obviate this source of error in quantitative determinations, there are three methods applicable: (1) Precipitation of the iron with ammonia. This can be effected either by precipitating and filtering off the ferric hydroxide and determining the sulphate in the filtrate (Lunge), or by adding barium chloride directly to the liquid containing the precipitated hydroxide and then adding hydrochloric acid to dissolve the latter (Küster and Thiel). (2) Keeping the iron in solution with an organic acid. (3) Reducing ferric to ferrous compounds. For this purpose sodium hypophosphite, stannous chloride, and sulphuretted hydrogen are open to objection, and the author proposes the use of zinc, either granulated or as dust. The results of analyses of sulphur in spent pyrites and in pig-iron, conducted according to the most reliable methods now in use, showed that the author's process is as accurate as any other; in particular, the results obtained by it agreed best with those obtained by the method of Küster and Thiel, and by the normal method (*i.e.*, fusing with sodium carbonate and potassium chlorate).—E. H. T.

Alkali Periodates, Determination of, &c. E. Péchard. Comptes Rend. 1899, **128**, [18], 1101—1104.

Disodium periodate, $Na_2H_3IO_6$, on treatment with a strong acid, yields the monosodium salt $NaIO_4$, which crystallises either anhydrous or with two or three molecules of water. This salt reddens litmus but is neutral to Methyl Orange. The author states that the chemical properties of the periodates are not similar to those of the iodates, but that they react as a combination of iodate and active oxygen; ozonated oxygen is slowly evolved from their solutions and iodate remains. The oxidation of oxalic acid, which serves as a method for the estimation of iodates, is not applicable for the active oxygen of the periodates, as the action is too slow, and the end not sharp. This difficulty may be surmounted by adding to the periodate solution sufficient manganous sulphate, and then oxidising the oxalic acid by means of the iodate and the active oxygen of the manganese dioxide produced. Other methods for the estimation of the active oxygen of the periodates are the oxidation of ferrous sulphate, either in acid solution, in which case the determination must be made rapidly, since the iodate produced slowly continues the oxidation, or in alkaline solution, when only the active oxygen reacts. Arsenious acid in alkaline solution also serves for the estimation, and here also the active oxygen alone is concerned. The author has studied the action of hydrogen peroxide on the periodates. Disodium periodate, alkaline to Methyl Orange, when added in the solid state to hydrogen peroxide, slowly decomposes the latter in the same way as soda. Monosodium periodate, neutral to Methyl Orange, when treated with hydrogen peroxide, gives off its active oxygen, liberating at the same time an equal volume of oxygen from the peroxide, according to the equation—

$$2NaIO_4 + 2H_2O_2 = 2NaIO_3 + 2H_2O + 2O_2.$$

When periodate is acidified with sulphuric acid and then treated with peroxide, a liberation of iodine occurs, as well as that of oxygen—

$$2HIO_4 + 7H_2O_2 = 8H_2O + 2I + 7O_2;$$

this reaction in presence of starch being a very delicate test for the presence of periodate in iodates. The passage of ozone through a solution of iodate brings about the slow formation of periodate, especially in alkaline liquids. Hence the constitution of the periodates is quite different from that of the iodates, and also from that of perchlorates, which do not give analogous reactions.—J. F. B.

Borax, Uses of Resazurine in Analysis of Commercial.

A. Lemoine. Bull. Assoc. Belge des Chim. **13**, [4], 185—187.

Since pure crystallised borax contains 47·14 per cent. of water, a rough estimate of quality may be obtained by determining the loss of weight on calcination; but, as this does not give the actual content of sodium borate, direct titration has to be employed. The best method is to dissolve 19·045 grms. of the substance in 1 litre of water, and titrate with decinormal acid, employing resazurine as indicator. The ratio between the volume of $\frac{1}{10}$-N acid and borax solution affords a measure of the percentage of sodium borate present.

For example, if 23 c.c. of borax solution consume 23·45 c.c. of $\frac{1}{10}$-N acid, the actual content of—

$$Na_2B_4O_7, 10H_2O = \frac{23 \times 100}{23 \cdot 45} = 98 \cdot 06 \text{ per cent.},$$

of which 51·835 is the weight of anhydrous borate and 46·225 water of crystallisation. The total water content having been determined as 47·120 per cent., the amount of moisture is therefore 0·895 per cent., the insoluble matter being 1·050 per cent.

For calcined borax, the percentage of anhydrous borate can be determined from the results of the titration by the equation—

$$\frac{\text{vol. } \frac{1}{10}\text{-N borax solution}}{\text{vol. } \frac{1}{10}\text{-N acid}} \times 52 \cdot 86.$$

—C. S.

Iron, Electrolytic Determination of, Sources of Error in the.

H. Verwer and F. Groll. Ber. **32**, [6], 806—809.

In opposition to Avery and Dales (this Journal, 1899, 300), the authors maintain that if iron be estimated electrolytically and "exactly according to Classen's method," neither does the deposit contain carbon, either as such or as carbide, nor does any trace of the iron remain behind in the electrolyte. Details of the experiments are given to prove their contention.—J. S.

Mercury in Antimonious and Arsenical Sulphide Ores by Means of the Gold-Surface Method, Estimation of.

F. Janda. Oesterr. Zeits. Berg u. Huttenw. 1899, **47**, 205; through Chem. Zeit. Repert. 1899, **23**, [16], 147—148.

The method of Eschka, as modified by Kroupa, using iron slag (Eisensinter) and zinc white, is by far the most convenient, but with samples containing antimony or arsenic sulphides, or organic matter, the deposit of mercury is often impure. In order to fix the resulting arsenious and antimonious acids, calcined sodium carbonate is used, and for the complete oxidation of the pyrites, powdered manganese dioxide. The heating is conducted over a Berzelius spirit lamp in a porcelain crucible. Iron scales are added to prevent the deposit of tarry matter on the crucible and cover. The zinc oxide decomposes the cinnabar. It is sufficient to heat the bottom of the crucible just to the glowing point; cinnabar volatilises at 310° C., and no zinc, antimony, or arsenic is reduced. The manganese dioxide can be omitted with oxidised ores, but is necessary with iron pyrites; an excess of dioxide oxidises some of the mercury. It cannot be satisfactorily replaced by lead chromate. For 0·5—10 grms. of ore 10 minutes heating is sufficient. The mercury mirror contains no antimony or arsenic, but sometimes traces of copper are present. The gold cover must be heated to redness slowly, to avoid loss of gold. The best mixtures are 1—10 grms. of ore, 6—9 grms. of iron slag, 1—2 grms. of manganese dioxide, 2—3 grms. of sodium carbonate; these are mixed and covered in the crucible with 3 grms. of iron slag and 4—5 grms. of zinc oxide; with oxide ores, the manganese is omitted.—J. F. B.

Zinc, Determination of, in Aluminous Ores.

E. Jensch. Zeits. angew. Chem. 1899, [20], 465—467.

The retention of zinc by the precipitate produced by ammonia in the analysis of zinc ores is found to be mainly due to the presence of much alumina in the ore. Repeated re-solution and re-precipitation, however, effectually overcome the evil. Four re-precipitations sufficed to give a precipitate of iron and alumina free from zinc in the worst instances quoted.—W. G. M.

Arsenic, Determination of, in Ores; A Modification of Pierce's Method for the.

J. F. Bennett, jun. J. Amer. Chem. Soc. 1899, **21**, [5], 431—435.

In Pierce's method the arsenic is brought into solution as an alkaline arsenate, carbonic acid expelled by boiling with an excess of nitric acid, and the liquid neutralised with ammonia, litmus paper being used as indicator. In Canby's modification of this method, an emulsion of zinc oxide is used to neutralise the solution. The author, having found it practically impossible to effect neutralisation in either way, has devised the subjoined method, which is based on the facts that on adding sodium acetate to a solution of arsenic and nitric acid, there is an immediate precipitation of silver arsenate, on the introduction of ammoniacal silver nitrate; and also that silver arsenate is only "more freely soluble in acetic acid than in solution of ammonium nitrate." By avoiding the presence of ammonium salts in the solution, phenolphthalein can be used as indicator.

The exact details of the process are as follows:—0·5 grm. of the finely-powdered ore is fused with from six to ten times its weight of a mixture of equal parts of sodium carbonate and potassium nitrate, and the mass treated with boiling water and filtered. The filtrate, which contains the arsenic as arsenate, is strongly acidified with acetic acid, covered, and boiled rapidly for a few minutes to expel carbonic acid. When cold it is neutralised with sodium hydroxide (phenolphthalein being used as indicator), and a neutral solution of silver nitrate added, with continual agitation. The precipitate, which subsides in a few minutes, is washed once or twice by decantation with cold water, collected on a filter, and washed thoroughly with cold water. It is then dissolved in dilute nitric acid, the solution made up to definite volume, and the silver determined by titration with standard potassium thiocyanate. Or the silver may be estimated directly in the precipitate by cupellation when chlorides are absent. In each case the amount of silver found is calculated into the corresponding amount of arsenic trisulphide.

The results of a large number of estimations of arsenic in impure arsenic trisulphides are given in the paper, to show the degree of accuracy of each method. In the scorification and cupellation method the average loss of silver amounted to 0·001 grm. when working with 0·025 grm. of impure trisulphide. By adding this to the amount actually found, the average results were in close agreement with those obtained by titration. The latter method also gave absolutely concordant results in four determinations of the amount of arsenic in a specimen of leucopyrite.
—C. A. M.

Phosphates, A New Solvent for distinguishing the Phosphoric Acid in various. W. Hoffmeister. Landw. Versuchs-Stat. 1898, **50**, 363—369.

Whilst Wagner and Maercker have shown that the phosphoric acid of bone-meal is not to be compared in value with that of basic slag, and Wagner's citric acid solution extracts far more phosphoric acid from the latter than from the former when the action is continued for half an hour, a greater amount of phosphoric acid (to 99 per cent.) is obtained from bone meal, when the action of the citric acid is prolonged to 5--6 days, than from basic slag (to 90 per cent.).

The following method gives results more in accordance with the ascertained manurial value of the two products. Humic acid (15 grms.), dissolved in dilute ammonia, is poured into a 2-litre flask containing some sand; the manure (5 grms.), and at least 1 litre of water, are then added, the whole shaken, and a moderately strong current of carbon dioxide passed through for 12 days, ammonia being frequently added. The liquid is then poured off, the sand washed, and the combined liquids, made up to a definite volume, are filtered, and four-fifths of the filtrate evaporated to dryness, after addition of hydrochloric acid. The residue is treated with water, containing a little hydrochloric acid, filtered, washed, and the filtrate made up to 100 c.c. Portions of this are used for estimating phosphoric acid, iron, and lime.

Basic slag, containing 16·7 per cent. of citrate-soluble phosphoric acid, gave 10·43 and 10·38 per cent. soluble in humic acid. In bone meal 1·01 per cent. dissolved in humic acid. When the basic slag is first rubbed with alcohol, results almost identical with Wagner's are obtained. The method is too complicated to supersede Wagner's for basic slag, and is intended to distinguish between different phosphates. The results obtained show the great importance of manufacturers supplying basic slag in the finest possible form.

Humic acid dissolved the following percentages of phosphoric acid in different manures—

——	P_2O_5.		
	Total.	Solution in Humic Acid.	
		Absolute.	Of Total.
	Per Cent.	Per Cent.	Per Cent.
Basic slag (fine)	19·20	18·49	95·8
Redonda phosphate (very fine)	35·71	10·85	30·38
Degelatinised bone meal	..	2·33	..
Fermented bone meal.......	..	2·21	..
Bone precipitate	30·14	13·01	43·3

The humic acid is prepared by extracting wood-lignin with ammonia. It is proposed to apply the method to other manures.—N. H. J. M.

Water Analysis, Resazurine as an Indicator in. A. Lemoine. Bull. Assoc. Belge des Chim. **13**, [4], 178.

The use of resazurine in this connection extends to the estimation of carbon dioxide combined with alkalis or alkaline earths in the form of neutral carbonates, as well as of the semi-combined dioxide assisting to retain the carbonates of the alkaline earths in solution; and the dissolved carbon dioxide. It also serves to reveal the alkalinity due to the presence of calcium hydroxide and magnesium hydroxide in solution.—C. S.

ORGANIC CHEMISTRY.—QUALITATIVE.

Organic Dyestuffs, Spectroscopic Analysis of. J. Formánek. Zeits. f. Unters. d. Nahr- und Genussmittel, **2**, 1899, 260—273.

The methods hitherto published for the detection of dyestuffs are all more or less complicated (this Journal, 1893, 3, and 1898, 798), and are not applicable for rapid and accurate determinations. The author suggests the use of the spectroscope for these investigations, and states that the results obtained exceed in accuracy and delicacy any method previously employed. He finds that solutions of different dyestuffs show absorption bands, and he has accurately determined the position of the maxima of these. It is, however, found: (1) That the bands of some dyestuffs in the same solvent are very close together. (2) That some dyestuffs do not possess any absorption bands; and (3) With a small dispersion the absorption bands of some different dyestuffs are superposed. In order to obviate these difficulties the dyestuffs are examined in different solutions, by which the positions of the absorption bands are altered, or else the same effect is produced by adding acids or alkalis. For example, the alcoholic solution of Eosine is decolorised by acids, whilst an alcoholic solution of Rhodamine S is decolorised by alkalis. In a similar manner the aqueous solution of Naphthol Yellow is decolorised by acids and that of Auramine by alkalis. Moreover, the solutions of those dyestuffs which do not yield distinct absorption bands are altered in colour by acids or alkalis. For example, the aqueous solution of Metanil Yellow, which only shows an absorption in the blue, is coloured carmine by nitric acid and gives an aborption band. In the case of a mixture of Rhodamine and Magenta, where the absorption bands lie very close together, the addition of nitric acid causes a displacement of the Magenta band to the left, and a similar effect is produced by adding nitric acid to a mixture of Methyl Violet and New Blue R, when the band of the former moves towards the left. Different groups of dyestuffs have different shaped bands, and according to the author the red and blue dyestuffs each fall into seven groups and the green and yellow each into five groups according to the shape of their absorption bands. The method consists in determining by means of a spectroscope having a suitable dispersion the particular group to which the dyestuff belongs by the shape of the absorption band. The position of the band is then noted on the scale, and if these determinations are not sufficient to identify the dyestuff the solution is divided into three parts and treated with nitric acid, ammonia, and potash lye respectively. The change of colour and of spectrum are noted, and from these observations the dyestuff is found in tables arranged for this purpose. These give the position of the absorption bands in water and in ethyl and amyl alcohol in neutral, acid, and alkaline solution. Numbers are also given referring to the scale of the apparatus employed and giving the wave length, so that the scale numbers may be calculated for any other apparatus. Some specimen tables are given in the paper and as showing the exact manner in which simple colours can be identified; it is possible by this method to distinguish between Methyl Violet B and 6 B, Phloxin, Phloxin B, and Phloxin 2 B. A complete series of tables and spectra is to be subsequently published.—T. A. L.

Cotton Seed Oil, Halphen's Reaction for the Detection of. P. Soltsien. Zeits. öffentl. Chem. **5**, 106—107; Chem. Centr. 1899, **1**, [18], 1049.

The author has investigated the reaction of Halphen (this Journal, 1897, 1045), and found that it also takes place without amyl alcohol and sodium chloride. 10 grms. of fat are heated with 2 grms. of a 1 per cent. solution of sulphur in carbon bisulphide in a wide test-tube, closed with a cork carrying an upright tube blown out above to a bulb. The coloration formed is compared with that of a standard test-solution, such as a solution of potassium bichromate.

The age and rancidity of the sample do not influence the reaction. In colourless fats and clear oils, 1 per cent. of cotton-seed oil may be detected with certainty; in coloured oils, 2—5 per cent., according to the strength of the colour. Cotton-seed oil heated to 200° C. gives the reaction unaltered. The coloration appears to be completely permanent.

The following fats and oils gave no coloration at all with Halphen's reaction:—Lard; the same strongly rancid; old rancid lard oil; the same mixed with tallow; sesamé oil; various cheese fats; olive oil; rape oil; linseed oil; poppy-seed oil; cameline oil; codliver oil; earth nut (arachis) oil; and hazel-nut oil.—A. S.

Linseed Oil, Boiled; Distinction of Ordinary Linseed Oil from. F. Evers. Chem. Zeit. 1899, **23**, [31], 334.

In an official report of the Director of the Royal (German) Chemical Technical Research Laboratory, the following method is recommended:—If 12 c.c. of the oil be shaken up in a test-tube with 6 c.c. of a glycerin solution containing lead (1 c.c. of 20 per cent. NH_3 + 5 c.c. of a solution of 100 grms. of crystallised lead acetate in 150 c.c. of pure water and 32 grms. of pure glycerin), and the test-tube be placed for three minutes in boiling water, boiled oil will form a thick pasty emulsion, whilst ordinary linseed oil separates into two liquid layers, the bottom one of which consists of clear water. By this method, pure linseed oil can be distinguished from an oil that may have admixed with it, as much as 25 per cent. of boiled oil. The author found this process correct for all oils, boiled with driers; but boiled oil made without driers by mere boiling down to a certain volume whilst air or oxygen is blown in, behaves with a lead-glycerin solution like ordinary linseed oil. The above method is, therefore, nothing but a test for driers, which may be also discovered by boiling the oil with weak nitric acid, and testing the solution for metals.

To distinguish oils boiled without driers (blown oils), from ordinary linseed oil, the author can recommend the test as described by Morpurge (see this Journal, 1897, 470).
—S. K.

Glue, Animal and Vegetable, Method of Distinguishing. F. Evers. Chem. Zeit. 1899, **23**, [31], 333.

Dextrin, gum, or a mixture of both may be easily detected in animal size by boiling with Fehling's solution, which, in their presence, is reduced. Wheat gluten, however, very much resembles animal glue, particularly an inferior bone glue. Each gives with tannic acid a gelatinous precipitate; both are precipitated only to a slight extent with a small quantity of aluminium sulphate, yield a floccular precipitate with excess, only show no change with lead acetate. Wheat gluten generally swells and dissolves in water less readily than animal glue. Both solutions form with NaOH a flocculent precipitate soluble when heated. On boiling these solutions for some time, and on addition of lead acetate, animal glue produces a white or greyish, the vegetable product an almost black, precipitate. Millon's reagent yields a reddish violet coloration with the gluten, like inferior animal glue. As a simple and a safe test, the author recommends the following:—1 grm. of the glue is dissolved, if necessary, with the addition of one drop of caustic soda in 10 c.c. of warm water. A few grms. of either chloride of sodium or magnesium sulphate are added. When shaken up, the solution of animal glue remains clear, the gluten giving a voluminous precipitate. Mixtures of the two may be detected by this method.—S. K.

Caramel in Spirits and Vinegar, Detection of. C. A. Crampton and F. D. Simons. J. Amer. Chem. Soc. 1899, **21**, [4], 355—358.

The method of detection is based on the observation that fuller's earth has a far greater affinity for the added caramel colouring matters than for those naturally absorbed from the wood during the process of ageing. 25 grms. of fuller's earth are added to 50 c.c. of the spirits, and the mixture beaten up in a beaker. It is allowed to stand for half an hour at the temperature of the room, and filtered. The percentage of colour absorption is determined by examining the sample in a Lovibond's tintometer before and after the treatment. If a tintometer be not available, a control sample of naturally coloured spirits of the same shade may be used. The examination of 40 samples of naturally coloured spirits showed a colour absorption of maximum 25·0 per cent., minimum 8·3 per cent., mean 14·6 per cent., whilst 18 samples coloured with caramel showed maximum 54·1 per cent., minimum 40·0 per cent., and mean 44·7 per cent. The powers of absorption of different samples of fuller's earth vary enormously, so that the results must be carefully compared with those from genuine samples. The process is also applicable to coloured vinegars.
—J. F. B.

Benzoic Acid, Examination of Pure, for Adulteration with Artificial. P. N. Raikow. Österr. Chem. Zeit. **2**, 121—122. Chem. Centr. 1899, **1**, [18], 1043.

Benzoic acid, which is to be used for medical purposes should be prepared by sublimation from resins, and should not be adulterated with the artificial acid prepared from toluene, as the latter always contains a certain amount of a chlorine derivative, formed in the course of manufacture, which cannot be removed by fractional sublimation or crystallisation. For the detection of adulteration with the artificial acid, the author recommends the application of the reaction between hydrochloric acid and phloroglucol-vanillin (Chem. Zeit. 1898, **22**, 20).

A portion of the sample is heated in the gas flame on a piece of platinum wire, and a porcelain dish moistened with the reagent held over the flame; the presence of chlorine is indicated by a red coloration.—A. S.

Cocaine, The New Test for (Schaefer's Chromic Acid Test). P. W. Squire. Chemist and Druggist, **54**, 641.

Schaefer's chromic acid test applied to six samples of cocaine hydrochloride of the best makers in the market, was found to give a distinct turbidity in all cases, either immediately, or in a few seconds. One gave a crystalline precipitate in two hours, and the others on standing over night. All gave crystalline precipitates, varying in the length of time of appearance with MacLagan's ammonia test. In no case did the turbidity produced by this last test equal the opacity or milkiness given by samples of undoubted impurity. Applied to a sample of Schaefer's cocainidine hydrochloride, the chromic acid test gave a distinct turbidity at once, but MacLagan's test gave no precipitate, even on standing 24 hours. The precipitate obtained by MacLagan's test from a good commercial sample of cocaine hydrochloride, was collected, washed, and dried over H_2SO_4, it then melted at 98° C. the melting point of pure cocaine. This shows that the statement of Günther, that the precipitate is not due to cocaine, but to an isomeride having a melting point of 110°—111° C. is incorrect. The base liberated from Schaefer's cocainidine hydrochloride melted at 94° C.—J. O. B.

Solanine, Telluric Acid as a Reagent for. Bauer. Zeits. für angew. Chem. 1899.

A solution of telluric acid in dilute sulphuric acid affords a delicate and distinctive reagent for solanine. When heated on the water bath with a solution of that alkaloid, it gives a bright raspberry-red colouration, which persists for two to three hours. No other alkaloids of common occurrence afford this reaction.—J. O. B.

Sandmeyer's and Gattermann's Reaction, An Electrolytic Modification of. E. Votoček and E. Zenišek. Zeits. für Elektrochem. **5**, [43], 1899, 485—486.

In this preliminary communication, the authors show how amido- and diazo-groups may be replaced by halogens, by means of an electrolytic method.

Conversion of Aniline into Chlorobenzene.—50 grms. of aniline were diazotised, and 170 grms. of crystallised copper sulphate added. Into this solution, which was kept cool by means of ice, there were introduced an anode, consisting of a spiral of stout copper wire, and a cylindrical copper cathode. With a cathodic current density of 1·6 ampères per sq. dcm., and an E.M.F. of 12 V., the evolution of nitrogen ceased after two hours, when it was found that the yield of chlorobenzene was 42 per cent. of the theoretical, whilst that of azo-benzene was 11 per cent.

In a second experiment the copper sulphate was replaced by 150 grms. of crystallised $CuCl_2$, when the yield of chlorobenzene amounted to 64 per cent. of the theoretical, with a current density of 2·1 ampères at 10 V. This experiment repeated with an excess of hydrochloric acid present gave a yield of 71 per cent.

In a similar way aniline may be converted into bromobenzene, *o*- and *p*-chlorotoluidine into *o*- and *p*-chlorotoluene, and β-naphthylamine into β-chloronaphthalene. In the last case an E.M.F. of 2 V. suffices, when a yield of 41 per cent. of the theoretical was obtained, as against 30 per cent. found by Gattermann with the older process.

The copper electrodes and copper salts when replaced by iron electrodes and ferrous salts gave very bad yields.

—J. S.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Acetic Acid, Separation and Estimation of, in Commercial Acetates. K. R. Haberland. Zeits. anal. Chem. 1899, **38**, [4], 217—226.

Acetic acid can be separated in a quantitative manner from its usual attendants, propionic, formic, and butyric acids, by a method based upon the following facts: basic lead propionate is nearly insoluble in hot water: zinc formate is insoluble in absolute alcohol: silver acetate is much more soluble in water than silver butyrate.

The commercial acetate is distilled with phosphoric acid, and the distillate containing the free organic acids is, after addition of litharge, evaporated to dryness. On dissolving the residue in cold water and then boiling, basic lead propionate separates; it is collected and converted into the silver salt. After the lead in the filtrate has been removed with sulphuric acid, zinc oxide is added, the liquid is evaporated to dryness, and the residue treated with absolute alcohol. A mixture of zinc formate and sulphate remains, from which the formic acid is liberated with phosphoric acid and then distilled over with steam into a standardised baryta solution. The alcohol is then driven off from the alcoholic solution of zinc acetate and butyrate, and these salts are heated in their turn with phosphoric acid and distilled with steam. To the distillate is added freshly prepared silver carbonate, and the silver salts so obtained are separated by crystallising from water, or they may be converted into the corresponding amyl esters which can be separated by fractional distillation.

Efforts to separate these acids by taking advantage of the different degrees of solubility of their barium salts in absolute alcohol, were not attended by success.

It was found, incidentally, that calcium acetate could not be prepared in the anhydrous state, as that body undergoes decomposition at 210° C., at which temperature dehydration is not complete.—E. H. T.

Hydrocyanic Acid, Note on the Determination of, by Liebig's Method. Lextreit. J. Pharm. Chim. 1899, **9**, [7], 323—325.

The author advocates the use of C 4 B Blue [Poirier's Blue] as the indicator of alkalinity during the titration of hydrocyanic acid, and of its salts by the classical Liebig method. C 4 B Blue has the advantage of being indifferent to the alkaline cyanides, which react alkaline with other indicators, but gives a sharp indication of the presence of free caustic alkalis, with which it develops a red colour. In this manner the use of too little or of too much added alkali is avoided. By the use of this indicator Engel has previously shown that free hydrocyanic acid may be determined by direct titration with alkali.—J. O. B.

Ferrocyanides and Carbonylferrocyanides, The Estimation of, and their Separation. J. A. Muller. Bull. Soc. Chim. 1899, **21**, [3], 475—477.

(*a*) *Ferrocyanides.*—A 0·4 to 0·5 per cent. solution of the ferrocyanide is slightly acidified with nitric or acetic acid, and lead nitrate or acetate solution added till no further precipitation occurs. After standing for 12 hours, the precipitate is filtered off, washed, dried, and treated with an excess of a mixture of five volumes of strong sulphuric acid with three volumes of water. The excess of acid is removed by gradually heating to a red heat, which is maintained for some time; by this means a mixture of lead sulphate and ferric oxide is obtained. The filter paper treated in the same way gives a similar residue, and these two are weighed separately. The total weight multiplied by 0·5378 gives the corresponding amount of potassium ferrocyanide.

(*b.*) *Carbonylferrocyanides.*—The dilute solution acidified with acetic acid is treated with excess of acetate of copper, and after 24 hours the precipitate is filtered off, washed, and treated with sulphuric acid of the same strength as in (*a*) above. After heating to redness to remove all carbon, the residue is dissolved in fuming hydrochloric acid, the copper precipitated as copper sulphide, which is then converted into the cuprous compound and weighed. The amount of cuprous sulphide multiplied by 2·787 gives the corresponding weight of potassium carbonylferrocyanide.

Separation.—The dilute solution of the mixed salts is slightly acidified with acetic acid, and a small excess of lead acetate solution gradually added with frequently shaking. The solution is then left in a dark place for one or two days until the precipitate settles; the supernatant liquid is carefully decanted off and filtered until clear. The carbonylferrocyanide in the filtrate is then precipitated by the addition of an excess of acetate of copper. The lead precipitate is dissolved in a slight excess of pure soda solution and the liquid poured into sufficient dilute acetic acid to give a distinctly acid solution. The lead compound is then reprecipitated, the liquor allowed to stand as before, and the filtrate precipitated with acetate of copper. This process of solution and reprecipitation of the lead compound is repeated until all the carbonylferrocyanide is removed from it. The two precipitates are then treated as described under (*a*) and (*b*).—T. H. P.

Iodine in Organic Matter, Detection and Estimation [Colorimetic] of Small Quantities of. P. Bourcet. Comptes Rend. 1899, **128**, [18], 1120—1122.

The material is finely chopped or powdered, moistened with a dilute solution of potash free from iodine, and dried at 100° C. The dried mass is again powdered and then melted with pure potash in a nickel capsule. The melt is extracted with boiling water until the filtrate is no longer alkaline; the solution is evaporated to half its volume and neutralised with sulphuric acid diluted with five times its weight of water, precautions being taken to avoid rise of temperature. When neutral, a few drops of potash are added to slight alkalinity and half its volume of 95 per cent. alcohol is added whilst stirring. Most of the potassium sulphate is thus precipitated and is drained off and washed with 30 per cent. alcohol. The filtrate and washings are concentrated to one third of the original volume and 90 per cent. alcohol is added. The further precipitate of potassium sulphate is separated as before and the process repeated until the whole has been removed, the iodine remains in solution in the alkaline alcoholic liquors. The last liquor is evaporated to dryness and slightly ignited for the destruction of any organic matter. It is cooled, taken up with a minimum of hot water and filtered and the iodine is then estimated in the few c.c. of filtrate obtained. The process used for this is that indicated by Rabourdin and later by Nicloux, namely, colorimetrically by decomposition with nitrous vapours in presence of carbon bisulphide.—J. F. B.

Carbohydrates, Notes on the Estimation of. F. W. Traphagen and W. M. Cobleigh. J. Amer. Chem. Soc. 1899, **21**, [4], 369.

In the determination of carbohydrates in grains, pods, &c., by their cupric reducing power after inversion, the authors recommend the following procedure:—100 c.c. of Fehling's solution are diluted with 100 c.c. of water and heated in a boiling water bath. The solution of inverted carbohydrate is caused to act upon this, and the precipitated cuprous oxide is collected on a Hirsch funnel covered with asbestos felt. After thoroughly washing with water, the top layer of asbestos, containing most of the cuprous oxide, is removed to the beaker in which the precipitation was made. The remaining asbestos is moistened and the cuprous oxide on the sides of the funnel rubbed off; water is added and the mass well stirred. 50 c.c. of a saturated solution of ferric sulphate in 20 per cent. sulphuric acid are added, and when the solution of the cuprous oxide is complete, it is filtered through the same funnel and the filtrate is titrated with potassium permanganate. The results so obtained are then compared with those found by treating an approximately equivalent quantity of starch or cane sugar (according to the nature of the carbohydrate) of known composition in the same way. Thus, errors introduced by the direct use of tables for cupric reducing powers are avoided. The authors prove that no oxidation or re-solution of the cuprous oxide takes place.—J. F. B.

Mercury, Estimation of; especially when occurring in Wine. A. Gayon and L. Laborde. J. Pharm. et Chim. 1899, **10**, 502—503.

As solutions of mercuric chloride are used for dressing vines to prevent fungoid growths on the same, the authors carried out a number of experiments to see whether this metallic poison could be detected in the wine prepared from the grapes of the vines so treated. It was found that the wine contained only infinitesimal traces of the metal. When mercuric chloride was intentionally added to grape juice, and the latter allowed to ferment, extremely small quantities remained in solution, practically the whole of the metal being precipitated by the yeast.

The method used for the separation of the mercury was shortly as follows:—One litre of the wine was gently heated with 150 c.c. of pure nitric acid until all action had ceased. The resulting liquid, after cooling, was subjected to electrolysis for about 12 hours, the mercury being thus completely deposited on the negative pole, a piece of gold or platinum foil serving for the latter. If present in considerable quantity, the metal was weighed on the electrode, but when only traces were obtained, it was re-dissolved in nitric acid and titrated with a standard solution of stannous chloride. (See this Journal, 1899, 509.)—W. P. S.

Oatmeal, Estimation of Wheatmeal in, by a Gravimetric Process. W. M. Doherty. Rep. of the Australian Assoc. for the Advancement of Science, Sydney, 1898, Section B., 336—338.

The author objects to the microscopical method of estimating the amount of wheatmeal present in oatmeal, on the grounds that it is a very difficult matter to obtain a slide that will fairly represent a large sample, whilst the quantity of the sample under observation in the microscopic field of vision is always so minute that the preparation of a large number of slides becomes necessary in order to obtain even an approximate degree of accuracy.

The author proposes a method based upon the difference in the quantity of fat naturally present in oats and wheat. It was found that of 20 samples of oatmeal, the amount of fat in 19 varied between 7·15 and 7·41 per cent., with a mean percentage of 7·27. In 12 samples of wheatmeal the amount of fat in one sample was 0·76 per cent., and in the others varied between 0·94 and 1·21 per cent., the mean percentage being 1·02. It is proposed to take these numbers as constants, *i.e.*, oat constant, 7·27; wheat constant, 1·02. In applying the method, the fat is extracted from 5 grms. of the meal by petroleum ether in a Soxhlet apparatus, the meal having been previously dried. The extract is freed from petroleum ether, and dried to constant weight at 100° C. The amount of wheatmeal in the sample is calculated as follows:—

$$\text{Percentage of wheatmeal} = 100\left(\frac{\text{Oat constant} - \text{percentage of fat in sample}}{\text{Oat constant} - \text{wheat constant}}\right).$$

—A. S.

Butter, Non-Volatile Fatty Acids in; Use of Resazurine as Indicator in Estimating. A. Lemoine. Bull. Assoc. Belge des Chim. **13**, [4], 187—188.

The object of washing the non-volatile acids on the filter being to remove the fixed salts (formed by the decomposition of the soap) and the free mineral acid, the author finds that 300—400 c.c. of distilled water are sufficient to carry off the latter, and consequently the former as well. Resazurine being inert towards soluble fatty acids, though reacting with mineral acids, may be used to detect the presence of the latter in the washings, and so enable their complete removal to be ascertained.—C. S.

Formaldehyde, Method for the Determination of. O. Blank and H. Finkenbeiner. Pharm. Zeit. 1899, **44**, 91; Chem. Zeit. 1899, 1.

Formaldehyde is oxidised into formic acid by means of hydrogen peroxide in the presence of an excess of alkali. A known quantity of standard alkali is added to the solution to be determined; neutral hydrogen peroxide is then added, and after allowing the mixture to stand for a few minutes to complete oxidation, the remaining free alkali is titrated in the usual manner. From the observed amount of alkali combined with the formic acid produced by the oxidation of the formaldehyde, the quantity of that substance originally present is calculated.—J. O. B.

Ethyl Alcohol, Detection and Estimation of, in Ether. Lassar-Cohn. Süddeut. Apoth. Zeit. **38**, 251.

The ether under examination is shaken with water, and the aqueous extract, after being heated to expel the ether contained in it, is distilled with manganese dioxide and sulphuric acid. If the distillate contains aldehyde, it will give a red precipitate with Nessler's reagent.

To determine the amount of alcohol present, the aqueous extract must be carefully freed from ether by heating to 60° C. and passing hydrogen through. The distillate is collected in 10 c.c. of $\frac{1}{100}$ N. iodine solution; on shaking this with 10 c.c. of a normal solution of caustic alkali, iodoform is formed; after acidifying with hydrochloric acid, the excess of iodine is determined.—E. H. T.

Eucalyptol, Scammell's Process for the Determination of. W. H. Allen. Chem. and Druggist, 1899, **54**, [1004], 641.

The author carried out a series of experiments to ascertain the value, or otherwise, of Scammell's phosphoric acid process (this Journal, 1894, 1106) for determining the eucalyptol present in eucalyptus oils. He prepared artificially several eucalyptus oils containing known and varying quantities of pure eucalyptol, and then determined the latter in the following manner. 200 c.c. of the oil were treated with a suitable quantity of syrupy phosphoric acid, the mixture being kept cool by means of a freezing mixture; the resulting mass was dried by first pressing between blotting paper, then by wrapping in calico and blotting-paper, and allowing to remain for 12 hours under a press. The eucalyptol was separated by treating with warm water, and was finally washed by warm water to remove any adhering traces of phosphoric acid.

The author considers that the process is quite accurate enough for determining the eucalyptol in commercial eucalyptus oils, which contain more than 20 per cent. of eucalyptol. If the amount of eucalyptol be less than 20 per cent., the mass obtained is in such a soft condition, that the transfer of it to blotting-paper is practically impossible without considerable loss.—A. S.

Alkaloids, Estimation of, with Iodine Solution. M. Scholtz. Zeits. anal. Chem. 1899, **38**, [4], 226—229. (Compare this Journal, 1898, 612, 1076.)

According to Kippenberger, 1 mol. of an alkaloid in hydrochloric acid solution will, under suitable conditions, combine with three atoms of iodine to form a definite super-iodide $Alk.HI.I_2$, and a method of determining alkaloids was devised by him based upon this fact. The author combats both the theory and the practice of the method; from the results of experiments with atropine, he concludes that no quantitative relation obtains between the quantity of iodine absorbed and the amount of alkaloid employed. Also, that the modification of the method by which the alkaloid is first treated with a definite quantity of silver-potassium iodine before the iodine solution is added, was found to be inexact.—E. H. T.

Alkaloids, Estimation of, with Iodine Solution. C. Kippenberger. Zeits. anal. Chem. 1899, **38**, [4], 230—236. (See foregoing abstract.)

While admitting that the explanation of the reactions upon which his method is based is not complete, the author maintains its accuracy as regards results. The discrepancies between his results and those of Scholtz are caused by the latter not working with due regard to prescribed conditions, in particular as regards the quantity of potassium iodide present in the iodine solution employed.—E. H. T.

Dynamite and Gelatin Dynamite, Notes on the Analysis of. F. W. Smith. J. Amer. Chem. Soc. 1899, **21**, [5], 425—431.

For the analysis of a typical dynamite, the following process is recommended as giving satisfactory results:—10 grms. are dried in a desiccator for at least five days over sulphuric acid, and the loss taken as moisture. About the same quantity is extracted with ether in a Gooch crucible, the residue dried in an air-bath at about 80° C. for two or three hours, and the loss minus the moisture taken as nitroglycerin.

When only nitroglycerin and kieselguhr are present, the extraction is more difficult, and it is advisable to stir the mass with ether in a beaker and to wash the residue back into the crucible when free from nitroglycerin.

Nitre, when present, is extracted with cold water, the residue being washed with acetone so that it may be dried without affecting the starch, if any be present. The loss in weight is called sodium nitrate.

The residue is ignited until free from carbon, the loss being wood-pulp, flour, bran, &c., for the separation of which the author has not found any satisfactory method.

If the ash be considerable it is extracted with hydrochloric acid and the residue dried. The percentage loss is subtracted from that obtained in the ignition, the difference being called wood-pulp, &c. Twice the loss on extraction with hydrochloric acid represents the basic magnesium carbonate. This saves a separate determination of magnesium carbonate, and is based on the fact that that salt loses practically half its weight on ignition; thus the loss on ignition of a sample was 10·40 per cent., and on extraction with hydrochloric acid 0·90 per cent., whilst a quantitative determination of magnesium calculated as $Mg(OH)_2.3MgCO_3.3H_2O$ gave 1·8 per cent.

Lunge's nitrometer may be used as a check on the analysis. About 0·5 grm. of the dynamite is covered with about 10 c.c. of sulphuric acid in a small weighing bottle and left for from 12 to 18 hours. The whole is usually dissolved in the time, and the liquid is then introduced into the nitrometer and treated in the usual manner.

The following figures were obtained in the analysis of a dynamite by the foregoing method:—Moisture, 1·3; nitroglycerin, 39·6; sodium nitrate, 46·8; wood-pulp, 9·5; basic magnesium carbonate, 1·8; and kieselguhr, 1·0 per cent.

The analysis of gelatin dynamite is more complicated. The following is selected as a typical illustration:—Moisture, 0·4; nitro-glycerin, 33·7; sulphur, 1·9; resin, 7·0; sodium nitrate, 54·0; guncotton, 1·1; wood-pulp, 1·9 per cent.

The moisture is determined as before. About 15 grms. are weighed into a filter cone (C. S. and S.) and extracted in a Soxhlet apparatus with chloroform, the loss including nitroglycerin, sulphur, and resin. When the powder fuses in hot chloroform it must be removed from the cone and treated with cold chloroform in a beaker until most of the nitroglycerin is dissolved.

The residue from the chloroform extraction is extracted with water to remove the sodium nitrate. The residue is dried, weighed, and extracted with acetone, the loss being called guncotton.

The residual portion consists of wood-pulp and earthy absorbents, which are treated as described above.

The method often recommended, of extracting the powder with acetone first and precipitating the guncotton with chloroform, is said to yield too high results, owing to the simultaneous precipitation of sodium nitrate, which is dissolved to some extent by the acetone. An allowance can be made for this, however, by incinerating the guncotton and deducting the ash.

The chloroform solution is evaporated until nearly all the chloroform is expelled, and the residue taken up with glacial acetic acid. The precipitated sulphur is collected in a weighed Gooch crucible, and washed with a little strong alcohol to remove the resin.

The nitroglycerin is estimated by treating a suitable quantity of the powder with successive small portions of ether, which are filtered into a glass evaporating dish. The united extracts are allowed to evaporate spontaneously, and after 12 hours the residue can be washed into the nitrometer with acetic acid, care being taken to avoid an excess, which interferes with the reaction, or too small a quantity, in which case the decomposition is too violent.

With the greatest care in evaporation, some nitroglycerin is invariably lost, and the results are generally 1 per cent. too low.

The resin in the sample in question was recognised by its odour and estimated by difference. An attempt to determine it by titration with alcoholic potassium hydroxide was unsuccessful, on account of the simultaneous decomposition of the nitroglycerin.

When ammonium nitrate is present, as in many of the so-called flameless dynamites, the ammonia is estimated by distillation from aqueous solution and calculated as nitrate.

The author states that the two examples given are representative of the largest proportion of dynamites and gelatin dynamites used in the United States, though other mixtures, often of a fanciful nature, are occasionally met with. He regards the methods given by Guttmann ("Manufacture of Explosives." II.) as, in the main, reliable, but considers some of Sanford's methods unsatisfactory.

In the valuation of Chili nitre, the refraction method is stated to give results from 1 to $1\frac{1}{2}$ per cent. higher than those obtained by using the nitrometer and calculating the nitric oxide as sodium nitrate. This is be accounted for by the almost invariable presence of potassium nitrate and the occasional presence of potassium perchlorate. The latter is estimated by fusing the salt at a low temperature in the presence of cupric oxide, the increase in chlorides after fusion being calculated to potassium perchlorate. A complete analysis of one sample of Chili nitre gave the following results:—Moisture, 2·2; insoluble matter, 0·1; magnesium sulphate, 0·2; magnesium chloride, 0·1; sodium chloride, 0·4; potassium nitrate, 3·6; sodium nitrate, 93·4; potassium perchlorate, 0·0.

The amount of sodium nitrate found by the refraction method was 96·8 per cent.—C. A. M.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Acids of the Oxalic Series, The Solubility in Water of the Normal. F. Lamouroux. Comptes Rend. **128**, [16], 998—1000.

To test Henry's statement that the acids of this series containing an even number of carbon atoms are slightly soluble, the others very soluble, in water, the author has determined the solubilities of several of them at temperatures up to 65° C., at which temperature many of them begin to decompose in concentrated solution, with evolution of carbon dioxide. His figures show that the whole series, with the exception of malonic and glutaric acids, are but slightly soluble, and that the solubility decreases with increase of molecular weight.—J. T. D.

Potassium Nitrite in Fusion, Luminous Phenomena by the Action of certain Ammoniacal Salts on. D. Tommasi. Comptes Rend. 1899, **128**, [18], 1107. (See also this Journal, 1892, 868.)

If a crystal of ammonium chloride be thrown on the surface of potassium nitrite in fusion, a phenomenon is observed similar to that which takes place when a piece of potassium is placed in water. Ammonium sulphate gives a still more intense luminosity, and the effect of ammonium nitrate is most brilliant, the incandescent globule rotating very rapidly and producing a violet flame.—J. F. B.

Iodine in Sea Water. A. Gautier. Comptes Rend. 1899, **128**, [18], 1069—1075.

THE author has established that sea water, taken at the surface or at a slight depth on the open sea, contains sensible quantities of iodine (2·4 mgrms. per litre, for instance), but that practically none of this exists in saline combination. The iodine is present wholly in organic combination, and can only be estimated after the destruction of the organic matter. About one-fifth of this iodine is fixed in the microscopic organisms of the water, and is removed by filtration through porcelain; the rest is in the state of soluble organic compounds. An analogous condition is probably the case for the greater part of the bromine present in sea water.—J. F. B.

Crystallised Cuprous Phosphide, The Preparation and Properties of. G. Maronneau. Comptes Rend. **128**, [15], 936—939.

BY reducing cupric phosphate with carbon in the electric furnace a substance of formula Cu_5P is obtained. It forms a crystalline powder of density 6·4, readily attacked by fluorine, but by the other halogens only at a red heat; easily attacked by oxygen or by sulphur when heated, but hardly affected by acids in the cold, save nitric acid. The authors have separated the same substance from the copper phosphide of commerce.—J. T. D.

Cyanide Poisoning. J. Loevy. Eng. and Mining J. 1899, **67**, [21], 618.

IN view of the unfortunate death by cyanide poisoning of Mr. Thomson, at the works of the New Comet Gold Mining Company, the author puts forward the following suggestions, and considers that safety can be provided if they are followed.

A certain quantity of pure peroxide of hydrogen, distilled water, and a Pravarz syringe should be kept in every cyanide plant, and all workmen on the plant should be made acquainted with the method of preparing a solution of the required strength—2 per cent.—and of injecting it subcutaneously. The peroxide of hydrogen should be kept in small bottles containing about ½ oz., with tight-fitting glass stoppers, and kept in the dark to prevent decomposition. —A. S.

Alcoholic Fermentation, Influence of the Pancreas on. Lépine and Martz. Comptes Rend. **128**, [15], 904—906.

THE authors have made a number of experiments in which they have added to a sugar solution sown with yeast, quantities of the pancreas from a dog, thrown into boiling water for five minutes, either when freshly procured, or after a preliminary heating for longer or shorter periods in water at 40°—45° C. Some of the former samples were added immediately after removal from the boiling water, some after the nerves had been excited by an electric current for a quarter of an hour. In all cases the amount of sugar fermented was greater than in comparative experiments without addition of pancreas. Excitation of the nerves increases the activity of the pancreas, so does heating in water at 45° C. for half an hour. If the heating be prolonged, however (two hours), the amount of sugar destroyed in a given time is less than with the freshly-boiled pancreas, though the quantity of carbon dioxide produced per grm. of sugar destroyed is greater than in the case either of the freshly-boiled sample, or of that boiled after half an hour's heating.—J. T. D.

Bismuth Peroxides. C. Deichler. Zeits. für Elektrochem. 1899, **5**, 517—521.

CHLORINE has no action in the cold on bismuth trioxide suspended in solutions of caustic potash. At the boiling point, mixtures of Bi_2O_3 and Bi_2O_4 are obtained from solutions of potash of sp. gr. 1·05—1·35, and mixtures of $KBiO_3$, and lower oxides from solutions of sp. gr. 1·39—1·5. When the chlorine is produced by electrolysis better results are obtained. A solution of caustic potash and potassium chloride containing suspended bismuth trioxide is placed in a platinum dish, which forms the anode, the cathode (platinum or carbon) being surrounded by a porous earthenware vessel. With potash-lye of sp. gr. 1·4 to 1·5, a dark red deposit is formed on the anode, consisting of pure potassium bismuthate, $KBiO_3$, whilst the suspended Bi_2O_3 remains unchanged. The most favourable conditions are: 150 grms. of caustic potash solution of sp. gr. 1·42 to 1·45 to 10 grms. of Bi_2O_3 and 15 grms. of KCl, electrolysed at boiling point, with a current density at the anode of 0·02 to 0·03 ampère per sq. cm. The current efficiency is from 90 to 96 per cent. When potassium bismuthate is boiled for a short time with concentrated nitric acid, a mixture of bright scarlet bismuthic acid, $HBiO_3$, with a little orange-yellow, $Bi_2O_4.2H_2O$, is obtained. When a potash solution of sp. gr. 1·37 is used in the electrolytic preparation, a small quantity of potassium bismuthate is deposited, the suspended Bi_2O_3 being converted into dark brown Bi_2O_4, which may be separated from admixed Bi_2O_3 by digestion with cold dilute nitric acid. With caustic soda in place of potash, homogeneous products were not obtained. The electrolysis of solutions of Bi_2O_3 in alkaline tartrates yields a dark-brown deposit of Bi_2O_4 at the anode; the same deposit is formed in very small quantities with solutions of the nitrate or sulphate. Bismuth tetroxide, Bi_2O_4, is very readily prepared by adding a solution of potassium persulphate to a solution of caustic potash of sp. gr. 1·1 to 1·35 containing Bi_2O_3 in suspension.—T. E.

Furfural, Oxidation of, by Hydrogen Peroxide. C. F. Cross, E. J. Bevan, and T. Heiberg. Proc. Chem. Soc. **15**, [210], 130—131.

THE results described in this paper are obtained by interaction of the aldehyde and peroxide in dilute aqueous solution (2—4 per cent. furfural) at 40° in presence of iron salts in small quantity. The peroxide is added until the characteristic reaction of the aldehyde with aniline acetate is no longer obtainable, the quantity of peroxide required being two or three molecules per molecule of furfural.

The main product of oxidation is recognised by its reactions with phenylhydrazine (formation of hydrazone), and with phloroglucinol and hydrochloric acid (deep red-violet coloration followed by precipitation of the colouring matter) to be a furfural derivative. Analysis of the hydrazone shows it to be the hydrazine derivative of a hydroxyfurfural.

Special interest attaches to the hydroxyfurfural which has been thus obtained. Its reactions with phloroglucinol and with resorcinol in presence of HCl are similar to those of the lignocelluloses. These colours may be developed on a pure cellulose cloth or paper for comparative study. It is then seen that the brilliant colours of the original products—blue with resorcinol, violet with phloroglucinol, give place to "flattened" shades, grey and brown respectively, on washing with ordinary water.

By means of these reactions, it is now shown (1) that a furfural-phenol is a constituent of the lignocelluloses; (2) that the colour reactions of these "natural" products with the hydroxybenzenes are due to the presence of such compounds; (3) that the equally characteristic reactions of the lignocelluloses with aniline salts are reactions with a second constituent group, *e.g.*, the keto-R-hexene complex.

A furfural-phenol being a normal product of the condensation processes accompanying lignification, it is probably also a product of the action of the condensing acids used in estimations of furfural. It appears, therefore, that the furfural actually isolated does not necessarily represent the entire production of furfurane derivatives; and these observations supply the basis for a further differentiation of the complex group of furfural-yielding plant constituents or furfuroids.

PATENT.

Iron, Oxide of; Impts. in the Production of. W. S. Rock, St. Clements, Jersey. Eng. Pat. 26,391, Dec. 13, 1898.

IRON is exposed to the action of sea-water, or other water containing mineral salts, so as to oxidise it, and the oxide formed is separated by washing, or in any other suitable manner. The action may be increased by making the electrical connection between the iron and pieces of carbon, or of a suitable metal, such as copper; and the compounds of iron, such as sulphates, formed during the process may be reduced to oxides by heating them in the presence of air. —G. H. R.

New Books.

Sewage Analysis. A Practical Treatise on the Examination of Sewage and Effluents from Sewage. By J. Alfred Wanklyn and William John Cooper. Including also a Chapter on Utilisation and Purification. Kegan Paul, Trench, Trübner and Co. Ltd., Paternoster House, Charing Cross Road, London. 1899. Price 7*s.* 6*d.*

This is a crown 8vo volume, containing preface by Prof. Wanklyn; table of contents; introduction of 17 pages, and eight chapters of subject-matter, occupying 104 pages, with a final appendix filling 90 pages. The work ends with an alphabetical index of subject-matter.

The matter treated of in the eight chapters referred to, is thus classified:—I. Specific Gravity of Sewage and Sewage Effluents. II. Chlorine. III. Sulphates in Sewage and Sewage-Effluents. IV. The Carbonic Acid in Sewage and Sewage-Effluents. V. The Ammonia-Method of Sewage-Analysis. Free and Albuminoid Ammonia. VI. The Moist Combustion Process applied to Sewage and Sewage-Effluents. VII. The Total Solid Residue: its Amount and Examination. General Statement of Analytical Results. VIII. The Utilisation and Purification of Sewage.

Appendix.—Chemistry of Manganese. Action of Permanganate of Potash on Urea, &c., in strongly Akaline Solutions. Water Analysis: Determination of Cellulose and Modified Cellulose in Drinking Water. Action of Alkaline Solutions of Permanganate of Potash on Certain Gases. The Moist Combustion Process, &c. Products of the Oxidation of Wool. Cyano-propionic Acid, &c. On a Proposed Method of Preventing the Fermentation in Sewage and the Formation of Sewer Gases, &c. On the Comparative Effect of Lime and other Chemicals on Sewage.

Anleitung zur Darstellung Chemischer Präparate. Ein Leitfaden für den praktischen Unterricht in der anorganischen Chemie. Von Professor Dr. H. Erdmann, in Halle. Zweite Auflage. H. Bechold, Frankfurt a/M. 1899. Price M 2.50. H. Grevel and Co., 33, King Street, Covent Garden, London.

8vo volume with preface, table of contents, 86 pages of subject-matter, and alphabetical indexes of authors and subjects. The text is illustrated with 15 cuts.

The work may be designated a collection of practical methods of preparation of inorganic compounds, representing all the leading metals and non-metals. The properties as regards purity, and the methods of testing the latter, are given in each case.

Les Nouveautés Chimiques pour 1899, Nouveaux Appareils de Laboratoires, Méthodes Nouvelles de Recherches Appliquées à la Science et à l'Industrie. Par Camille Poulenc, D. ès Sc. Libraire J. B. Baillière et Fils, 19, rue Hautefeuille, Paris. Poulenc Frères, 92, rue Vieille-du-Temple, et boul. Saint-Germain 122. 1899. Price 4 fr. H. Grevel and Co., 33, King Street, Covent Garden, London, W.C.

Crown 8vo volume, with preface, 346 pages of subject-matter, illustrated with 196 engravings, a table of contents, and the alphabetical index of subject-matter. The subjects treated of are as follows:—

I. General Applications of Physics and Chemistry. Thermometers. Determination of Specific Gravity, of Molecular Weight, and of Viscosity. II. Various Laboratory Apparatus. Heating. Distillation. Extraction. Illumination, among which are various forms of apparatus for the production of Acetylene. Mechanical Operations. Filtration. Vacuum or Compressed Air, &c. Production and Purification of Gas. Miscellaneous Apparatus. III. Chemical Analysis. Amongst others, Commercial Analysis. Metallurgy and Fuel. Saccharimetry. Chemical Industry. Analysis of Foods and Waters. Medical Analysis. IV. Electricity. V. Bacteriology.

Chemisch-technische Untersuchungsmethoden, mit Benutzung der früheren von Dr. Friedrich Böckmann bearbeiteten Auflagen, und unter Mitwirkung von C. Adam, L. Aubry, F. Barnstein, M. Barth, Th. Beckert, C. Bischof, O. Böttcher, C. Councler, K. Dieterich, K. Dümmler, A. Ebertz, C. v. Eckenbrecher, F. Erismann, F. Fischer, E. Gildemeister, R. Gnehm, O. Guttmann, E. Haselhoff, R. Henriques, W. Herzberg, D. Holde, W. Jettel, H. Köhler, E. O. v. Lippmann, J. Messner, W. Möslinger, C. Moldenhauer, G. J. Neumann, J. Pässler, O. Pfeiffer, O. Pufahl, G. Pulvermacher, O. Schluttig, C. Schoch, G. Schüle, L. Tietjens. Herausgegeben von Dr. Georg Lunge. Erster Band. Vierte, vollständig umgearbeitete und vermehrte Auflage. Julius Springer's Verlag. Berlin. 1899. Price M. 16.

Owing to the unfortunate ill-health of Dr. Böckmann, he has found it impossible to prepare a fourth edition of his work bearing the above title, the third edition having almost become exhausted, and hence he has resigned this duty in favour of Prof. Lunge, who now undertakes it. The present volume, No. I. of the fourth edition, is of large 8vo size, contains preface by Dr. Lunge, table of contents, and 811 pages of subject-matter, followed by an appendix containing 45 pages, devoted to tables. The text is illustrated with 146 engravings. The arrangement of the subjects is as follows:—General Portion and Subject (G. Lunge). Introduction. General Operations. I. Sample-taking. II. General Operations in the Laboratory. Special Subject. Technical Gas Analysis (F. Fischer). Apparatus and Processes for the Analysis of Gases. Investigation of Fuels. Manufacture of Sulphurous Acid, Nitric Acid, and Sulphuric Acid (G. Lunge). Saltcake and Hydrochloric Acid Manufacture (G. Lunge). Alkali Manufacture (G. Lunge). I. Leblanc's Process. II. The Ammonia-Soda Process. III. Manufacture of Caustic Soda. IV. Electrolytic Alkali Solutions. The Chlorine Industry (G. Lunge). Potash Salts (L. Tietjens). General Methods for the Estimation of Potash. Special Portion. I. Stassfurt Salts. II. Nitrate of Potash. III. Potash Salts. Cyanogen Compounds (C. Moldenhauer). I. Simple Cyanides. II. Double Cyanides, &c. Clay Analysis (C. Bischof). A. Chemical Analysis. B. Pyrometric Methods of Testing. Investigation of Earthenwares (K. Dümmler). A. Physical Methods. B. Chemical Analysis. C. Testing Roofing Slates. Alumina Preparations (G. Lunge). Raw Material. Analysis of Bauxite. Management. Alumina Preparations. Glass (C. Adam). Raw Materials. Composition and Testing of Glasses. The Mortar Industry (C. Schoch). I. Lime. II. Hydraulic Additions to Lime. III. Hydraulic Mortars. IV. Gypsum. The Air (E. Erismann). Water for Drinking and other Uses (E. Erismann). Chemical Investigation. Testing Water for Boiler Feeding Purposes, &c. (G. Lunge). Sewage (E. Haselhoff). The Soil (E. Haselhoff). A. Mineral Deposits, &c. B. Moorland Soils.

V. von Richter's Organic Chemistry, or Chemistry of the Carbon Compounds. Edited by Prof. R. Anschütz. Authorised translation by Edgar F. Smith, Professor of Chemistry, University of Pennsylvania. Third American, from the Eighth German Edition. Volume I. Chemistry of the Aliphatic Series. Kegan Paul, Trench, Trübner, and Co. Ltd., Paternoster House, Charing Cross Road, London, 1899. Price 15*s.*

This work is now to be issued in two volumes: I. The Chemistry of the Aliphatic Series, and II. That of the Aromatic Series. The present volume has just appeared; Volume II. is to appear later in the year. The present work is an 8vo volume containing prefaces, table of contents, and subject-matter filling 588 pages, and closing with an alphabetical index of subject-matter. The text is illustrated with 10 woodcuts. The divisions of the prime subject are as follows:—Introduction. Fatty Bodies. Aliphatic Substances or Methane Derivatives. Chain-like or Acylic Carbon Compounds. I. Hydrocarbons. II. Halogen Derivatives of the Hydrocarbons. Oxygen Derivatives of the Methane Hydrocarbons. III. The Monohydric Alcohols and their Oxidation Products. IV. Dihydric

Alcohols and their Oxidation Products. V. Trihydric Alcohols; Glycerols and their Oxidation Products. VI. Tetrahydric Alcohols and their Oxidation Products. VII. Pentahydric Alcohols or Pentites and their Oxidation Products. VIII. Hexahydric and Polyhydric Alcohols and their Oxidation Products. Carbohydrates. Animal Substances of Unknown Constitution.

Jahresbericht über die Leistungen der chemischen Technologie, mit besonderer Berücksichtigung der Elektrochemie und Gewerbestatistik für das Jahr 1898. Von Dr. Ferdinand Fischer. Mit 202 Abbildungen. Verlag von Otto Wigand, Leipsic, Germany. 1899. H. Grevel and Co., 33, King Street, Covent Garden, London. Price 24*s*.

The progress of Chemical Technology during the year 1898 is here recorded. Trade statistics, more specially referring to the German Empire, are also furnished. The last Jahresbericht contained 1,171 pages, the present one contains 1,222. Alphabetical indexes of names and subject-matter are given, filling 50 pages. An index of German patents follows those of names and subject-matter, and it covers six pages. The text is illustrated with 202 woodcuts.

The following is a synopsis of the subjects treated of in the volume, the extent of each group and its treatment being indicated by the number of pages filled:—

Group I. Chemical Technology of Fuel (pages 5 to 114). II. Chemical Metallurgy (115—235). III. Electro-Chemistry (236—323). IV. Chemical Manufactures: Inorganic (324—505). V. Chemical Manufactures: Organic (506—709). VI. Glass, Pottery, Cements; Artificial Stone (710—765). VII. Foodstuffs (766—989). VIII. Chemical Technology of Fibres (990—1124). IX. Other Industries concerned with Organic Chemistry (1125—1212). X. Apparatus (1213—1222).

For the advance of special branches as regards literature and invention, compare Jahresbericht review for 1897 (this Journal, 1898, 615).

Chemisch-Technisches Repertorium. Uebersichtlicher Bericht über die neuesten Erfindungen, Fortschritte und Verbesserungen auf dem Gebiete der technischen und industriellen Chemie, mit Hinweis auf Maschinen, Apparate und Literatur. Herausgegeben von Dr. Emil Jacobsen. 37. Jahrgang. 1898. Zweites Halbjahr. Zweite Hälfte. Mit in den Text gedruckten Illustrationen. R. Gaertner's Verlagsbuchhandlung, Hermann Heyfelder, Schönebergerstr. 26, Berlin, S.W. H. Grevel and Co., 33a, King Street, Covent Garden, London, W.C.

The present is the number of the "Repertorium" for the second half of the second half-year of 1898, and it treats of the following subjects of Chemical Technology:—I. Foodstuffs. II. Paper. III. Photography. IV. Residuals, Manures, Disinfection, and Sanitation. V. Soaps. VI. Explosives and Matches. VII. Preparation and Purification of Chemicals. VIII. Fine Chemicals, &c. IX. Chemical Analysis. X. Apparatus, Machinery, Electro-technology, and Thermo technology. XI. Appendix, &c. XII. New Books.

Fortschritte der Theerfarbenfabrikation und verwandter Industriezweige, 1890—1894. An der Hand der systematisch geordneten und mit kritischen Anmerkungen versehenen deutschen Reichs-patente. Dargestellt von Dr. P. Friedländer, Vorstand der chemischen Abtheilung des k. k. technologischen Gewerbemuseums in Wien. Vierter Theil. 1894—1897. Julius Springer's Verlag, Berlin. H. Grevel and Co., 33, King Street, Covent Garden, London. 1899. Price 2*l*. 10*s*.

Large 8vo volume in paper cover, containing preface, table of contents and 1,838 pages of subject-matter. Then follows an index of patents, showing, with dates, which have lapsed. This list fills 15 pages. After this follows another of patentees, duly classified; it covers 4 pages. The work concludes with an index of subject-matter, occupying 21 pages. The work as a whole is not only a compilation of all the patents referring to dyestuffs, but also to all those relating to "Fine Chemicals" of organic origin, and of Pharmaceutical or Therapeutic interest.

The classification is as follows:—Intermediate Products of the Coal Tar Industry (pages 1 to 165). Triphenylmethane Dyestuffs (pages 166 to 264). Anthracene Dyestuffs (pages 265 to 363). Quinone-imide Dyestuffs (pages 364 to 507). Naphthalene Derivatives (pages 508 to 643). Azo Dyestuffs (pages 644 to 1025). Indigo (pages 1026 to 1035). Acridine Dyestuffs (page 1036). Dyestuffs of Various Composition (pages 1045 to 1070). Pharmaceutical Products (pages 1071 to 1333). These include Antiseptics, Uric Acid Solvents, Anæsthetics, Astringents and Natural Alkaloids, "Saccharin" and "Dulcin," Vanillin, Artificial Musk and other scented substances, Eucalyptol, &c., &c.

With regard to the azo dyestuffs generally, these are subdivided as follows:—Wool Dyestuffs (pages 705 to 782). Azo Dyestuffs dyeing on Mordants (pages 785 to 802). Basic Azo Dyestuffs (pages 803 to 817). Primuline Dyestuffs (pages 824 to 872). Cotton Azo Dyestuffs from *p*-Diamines (pages 846 to 994). Cotton Azo Dyestuffs from Various Diamines (pages 976 to 1002). Azo Derivatives of Varied Composition (pages 1016 to 1024).

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

Customs Law of the Argentine Republic.

The following is a translation of the principal provisions of the Argentine Customs Law for 1899, as far as they relate to the import and export tariffs of the Republic:—

[*Note.*—In addition to the rates of duty prescribed in Articles 2 and 3 of this Customs Law and the supplementary tax leviable under Article 4, the following further surtaxes are to be collected up to December 31, 1899, in virtue of Law, No. 3,711, of September 22, 1898:—

(*a.*) On articles paying 2½ per cent. *ad valorem*, an additional 2½ per cent. *ad valorem.*

(*b.*) On articles paying 4 per cent. *ad valorem*, an additional 4 per cent. *ad valorem.*

(*c.*) On articles paying 5 per cent. *ad valorem*, an additional 5 per cent. *ad valorem.*

(*d.*) On articles paying more than 5 per cent. *ad valorem*, an additional 10 per cent. *ad valorem.*

(*e.*) On articles paying a specific rate of duty, an additional rate of 10 per cent. on their official valuation as set forth in the "Valuation Tariff."]

I.—*Import Duties.*

Article 1. Foreign merchandise when imported and the produce of the Argentine Republic when exported—unless duty free—shall pay the import or export duties set forth below:—

Article 2. The following articles shall be taxed *ad valorem*, and pay the percentage duties specified:—

§ 1, 25 per cent. *ad valorem*—
All articles for which a special duty is not fixed in this law or which are not exempted from duty.

§ 2, 50 per cent. *ad valorem*—
Ammunition, gunpowder, and perfumery.

§ 4, 40 per cent. *ad valorem*—
Borax, hides and skins tanned.

§ 7, 10 per cent. *ad valorem*—
White lead, ammonia, anhydrous, in cylinders; antimony, metallic; baryta, pulverised, barium sulphate, coal tar, pitch, degras, lead sheets, sulphate of lime, malt, sulphur, firebricks, zinc, tar oils, quicksilver.

§ 8, 5 per cent. *ad valorem*—
Nitrate of potash, crude; kaolin, carbonate of soda, soda ash, industrial silicate, nitrate and impure sulphate of soda, and caustic soda; sulphate of alumina, impure.

§ 10, 2½ per cent. *ad valorem*—
Asphalt, crude sulphur, caoutchouc (raw), fibres or wood pulp for manufacture of paper, gelatin for use with preparation of preserved meat.

Article 3.—The merchandise set forth below shall pay the following specific duties :—

Articles.		—
		Pes. cts.
Matches, wooden	Kilos.	0·40
„ of wax, stearine, &c., loose	„	1·60
„ „ in boxes of not more than 6 doz.	„	0·80
Stearine	„	0·08
Keroseine	Litre	0·03
Paper, coloured	Kilos.	0·12
„ white	„	0·03
Candles	„	0·10

All subject to a supplementary tax of 2 per cent. *ad valorem*, if subject to a duty of 10 per cent. or more, and of 1 per cent. *ad valorem* if subject to a lower duty.

III.—*Exemptions from Duties.*

Article 9.—The importation of the following articles shall be free of duty :—

Coke, dynamite and special powder for mines, specifics for curing sheep scab, serum for treatment of infectious diseases, impure naphtha or petroleum, water filters of the Pasteur or similar systems.

RUSSIA.

Tariff Decisions.

Note.—Russian pound = 0·9 lb. (avoirdupois) ; poud = 36 lb. (avoirdupois) ; rouble = 100 copecks = 3*s.* 2*d.*

Chamotte cement, containing not more than 10 per cent. of fragments of stone, to be cleared under point 2 of section 72 ; duty 6 cop. per poud. As fire-proof bricks are to be recognised, only those that possess a smelting temperature exceeding 1,300° Celsius. The foregoing rule shall not be applied to clinkers.

Natural mineral dye substances, containing an admixture of aniline, in whatsoever small a quantity, to be cleared under section 137 ; duty Rs. 4.50 per poud, as colouring substances not specially named. Under point 2 of section 125 shall be cleared natural dye substances only ; duty from 15 cop. to 52½ cop. per poud gross.

BULGARIA.

Prohibition of Importation of Oils.

In a communication to the Foreign Office, under the date of 22nd May last, Mr. Francis E. H. Elliott, H.M. Agent and Consul-General at Sofia, reports that the Bulgarian Official Gazette notifies that the importation of oil of cotton seed, and of edible vegetable oils, mixed with oil of cotton seed, continues to be prohibited. The notification adds that such oils are only admitted to importation when destined for industrial uses, and then only when rendered unfit for food by the addition of petroleum or turpentine at the expense of the importer.

The regulation which requires a sample of every consignment of edible vegetable oil to be forwarded to Sofia for analysis before it is allowed to pass the Customs, gives rise to much complaint. The analysis frequently takes several weeks, during which the importer is not only deprived of his goods, but is compelled to pay warehouse dues upon them to the Custom House.

UNITED STATES—CUBA.

Tariff Modifications.

By direction of the President, Notes 1 and 2 of Group 4, Class XI., of the "Amended Customs Tariff and Regulations for Ports in Cuba in Possession of the United States," are hereby suspended. (See *Board of Trade Journal* for March, 1899.)

By direction of the President of the United States certain paragraphs of the "Amended Customs Tariff and Regulations for Ports in Cuba in Possession of the United States," are amended so as to read as follows :—

Inorganic Salts.

(*a*) Chloride of sodium (common salt), crude, G.W., 100 kilos., 20 cents.

(*a*½) Chloride of sodium (common salt) ground, powdered, manufactured or otherwise, G. W., 100 kilos., 50 cents.

(*b*) Chloride of potassium, sulphates of soda, iron, or magnesia ; carbonate of magnesia ; alum, G.W., 100 kilos., 45 cents.

(*c*) Sulphate of ammonia ; phosphates and superphosphates of lime, nitrate of potash and soda, G.W., 100 kilos., 3 cents.

(*d*) Other salts of ammonia ; salts of copper, chloride of lime, sulphate of potash, hyposulphite of soda and borax, G.W., 100 kilos., 75 cents.

(*e*) Chlorates of soda and potash, G.W., 100 kilos., 1.80 dols.

16. Articles of fire clay, G.W., 100 kilos., 30 cents.

372. Bricks, glazed and unglazed, for building purposes, free.

16½*. Vitrified brick for paving purposes, vitrified block, vitrified brick for sewers, vitrified invert block, and vitrified invert brick for sewers, G.W., 100 kilos., 5 cents.

18*. Vitrified clay and terra cotta sewer pipe, slabs or conduits of clay, glazed or unglazed, cement or stoneware, G.W., 100 kilos., 25 cents.

BELGIUM.

Excise Duty on Glucoses.

According to a decree published in the ***Moniteur Belge***, the decree of the 19th May 1898, remitting part of the Excise duty on glucoses when employed in certain specified industries, has been modified when referring to glucoses employed in the manufacture of colouring matter.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

THE SUMACH TRADE OF SICILY.

Bd. of Trade J., June, 1899, 722.

Her Majesty's Consul at Palermo states that the 1898 crop of sumach in Sicily was estimated at 30,400,000 kilos., to which must be added about 6,000,000 kilos. brought forward from the 1897 production, forming in all an available stock of leaf of 36,400,000 kilos., equivalent to about 35,862 tons English weight.

To this must be added about 3,600,000 kilos. of lentisco or stinco, imported from the coast of Tunis ; in addition to which several of the grinders carried forward a certain quantity of lentisco from the importation of 1897, which they had not been able to consume, estimated at 1,120,000 kilos.

The Palermo Custom House figures for the exports for 1898 are 37,120,962 kilos., of which 20,668,136 were ground sumach.

The stock of sumach leaf still for sale in Sicily is calculated at about 2,000,000 kilos., and this was expected to be used up before the middle of June.

The old lentisco stocks were all exhausted by the end of April ; three cargoes of the new crop arrived within the past week and have already been transformed into ground sumach, other cargoes are daily expected.

THE SICILIAN SULPHUR TRADE.

Bd. of Trade J., June 1899, 723.

The *Giornale de Sicilia* of the 6th—7th May, reports as follows :—

"According to the estimates made by the Sicilian Chambers of Commerce the production of sulphur during 1899 will certainly exceed half a million tons. All the Sicilian mining districts are vigorously employed increasing the output. The increase is due to the greater demands from the United States owing to the late war ; also to demands from Germany, Greece, and France, where sulphur is being used in the treatment of vines. On the other hand, a decrease of about 15,000 tons over the consumption of 1898 is expected from Italy and Russia.

The exports of sulphur to the United States during 1899 are estimated to reach 110,000 tons.

The prospects for 1899 are estimated as follows:—

—	Tons.
Stock on hand on December 31st, 1898	248,000
Production during 1899	500,000
Total amount available	748,000
Estimated total exportation during 1899	400,000
Estimated left on hand on December 31st, 1899	348,000

It is estimated that the stocks on hand on the 31st December, 1900, will be still greater.

Paper Mills in British India.

Bd. of Trade J., June 1899, 729.

According to a return issued by the India Office, there are nine paper mills in India; three in the Bombay Presidency, four in Bengal, one at Lucknow, and one at Gwalior which has ceased to work. Of the nine, two are private concerns in the Bombay Presidency. The others have an aggregate nominal capital of Rx. 627,200. The fibrous materials used for making paper are chiefly rags, bábui and munj grasses, straw, jute, and hemp cuttings, and old jute bags and cloth. The quality of the papers made is very good, and they have a large and increasing sale. Most of the white and blue foolscap and much of the blotting paper, notepaper, and envelopes used in the Government offices is now obtained from the Indian mills. The total quantity of paper made in 1898 was 42,000,000 lb.; 10 years previously it was under 20,000,000 lb.; value of the outturn in 1898 is reported at about Rx. 611,000. The number of persons employed is 4,187.

Dynamite Factory in the Transvaal.

U.S. Cons. Reps., June 1899, 381.

Consul Macrum writes from Pretoria, February 4, 1899, that he has recently visited the dynamite factory. The company has an initial investment in ground and buildings of 600,000*l.*, and carries a stock of from 700,000*l.* to 800,000*l.* at all times. The Government granted this company the sole right to import, manufacture, and sell explosives in the State for a period of fifteen years, of which about five have passed, the Government receiving a royalty from every case sold. Much opposition is shown to the monopoly by the mining companies on the Rand and elsewhere in the State, as they claim that, while they pay about 3*l.* 15*s.* for No. 1 dynamite now, if the monopoly were cancelled the same quality could be laid down at the mines at not more than 2*l.* 5s. per case of 50 pounds, allowing the Government a reasonable import duty. Mr. Macrum sends copy of the report of the State analyst on the factory.

Chemical Trade of Baden in 1898.

Foreign Office Annual Series, No. 2272, *May* 1899.

In heavy chemicals there was little improvement to report. For acids, a better demand existed, but sharp competition kept down prices. Soda manufacturers declare that they will be ruined without a protective duty. Superphosphate makers complain that by the influence of the agrarian policy foreign firms are allowed to place their make in the German markets at reduced railway rates, while German firms are refused such accommodation, and the export of superphosphate to the United States consequently grows difficult. Coal-tar supported by English prices was in better demand. Benzol fell in value until it was almost unsaleable. An improvement is, however, expected by the creation of a syndicate of the coke works on the Ruhr. Toluols, xylols, and naphthols remained active at cheaper prices. Crude carbolic acid was neglected throughout the year, while crystals were regularly asked for at steady prices. Makers of varnish and lacquer complain of British and American competition.

Oils and Chemicals at Zante in 1898.

Foreign Office Annual Series, No. 2269, *May* 1899.

The olive oil crop was again a failure, estimated not to exceed 2,000 tuns. Consequently prices ranged too high to compete with other exporting markets, and only about 80 tuns of white oil have so far been exported, costing about 29*l.* per tun of 256 Imperial gallons f.o.b. The greatest part is sold for local consumption, for the supply of markets on the mainland opposite, and also for soap making, of which over 32,000 boxes (50 okes or 142 lb. each) of a total value of 1,440,000 dr., or 38,000*l.* sterling. Green oil, extracted from the stone of the olive, is also produced, and used principally in soap boiling; about 550 tons were exported to other parts of Greece and also to Turkey. Its cost, according to the season of the year and quality, varies from about 24*l.* to 30*l.* per ton f.o.b.

Soda ash, principally shipped at Runcorn and used for soap-making, was imported to the value of about 3,000*l.*

Sulphate of copper is now in general use to check the peronospora disease, which has of late years attacked the vines; a good deal comes from other Greek ports, originally shipped from Liverpool.

Manures and Copper Sulphate in Elba.

Foreign Office Annual Series, No. 2274, *May* 1899.

Artificial and chemical manures were introduced into Elba in considerable quantities for the first time last year, and these, together with sulphate of copper, might with advantage be imported direct from Great Britain.

Chemical Trade of Genoa in 1898.

Foreign Office Annual Series, No. 2268, *May* 1899.

The import of chemical products was nearly the same as the previous year, Great Britain, Germany, and America being the largest suppliers.

Of 434 tons of acids, France sent 176 tons, Great Britain 66 tons, Germany 47 tons, and Austria 75 tons, while 70 tons came from other countries.

Belgium sent 4,004 tons and Great Britain 355 tons of potash and caustic soda, out of a total import of 4,359 tons.

Of oxides (727 tons), Great Britain supplied 437 tons and Germany 79 tons.

Out of 5,160 tons of carbonates, 2, 769 tons came from Great Britain, 228 tons from Germany, 616 tons from France, 1,328 tons from Belgium, and 219 tons from other countries.

The import of chlorides amounted to 5,788 tons, Great Britain sending 1,771 tons; Germany, 1,608; France, 2,194 tons; other countries, 215 tons.

Of the 13,598 tons of sulphates, Great Britain was responsible for 11,219 tons; Germany, 417 tons; Belgium, 43 tons; France 7 tons, and other countries 1,912 tons.

There were 2,160 tons of paraffin (*parafina solida*) imported: 609 tons from Great Britain, 9 tons from Germany, and 1,552 tons from America and Canada.

In gums and resin, 669 tons came from Great Britain; from France, 440 tons; from Russia, 353 tons; and from North America, 7,358 tons, while the remainder came from other countries.

Of the 21,593 tons of dyestuffs imported, France sent 577 tons; Spain, 575 tons; Turkey, 5,144 tons; Asiatic-British possessions, 890 tons; Great Britain, 427 tons; South America, 2,817 tons; and North America, 11,163 tons.

There were nearly 2,000 more tons of fats imported in 1898 than during the preceding year; 3,610 tons coming from Great Britain; 784 tons from France; 790 tons from Belgium; 8,860 tons from Central America; 3,048 tons from North America; 28 tons from Australia; and from other countries 423 tons.

Great Britain supplied 2,808 tons of manures; Belgium, 5,235 tons; France, 4,011 tons; Germany, 152 tons; America, 133 tons, while 457 came from other countries.

The time has come when the British manufacturer must seek this market, and not wait for orders to be sent in, or the commercial travellers of other countries will, in the absence of British travellers or agents, take the orders, more especially as the former save the buyer much trouble by quoting prices in Italian currency for free delivery, executed more expeditiously by the foreigner than by British firms. Already in Genoa, German cutlery is fast assuming the lead.

Potato Starch and Dye-Woods at Hamburg in 1898.

Foreign Office Annual Series, No. 2263, *May* 1899.

The German potato starch manufactories are stated to have done a profitable business last year. The extensive demand for grape-sugar had the effect of clearing off all stocks of various qualities of potato, flour, and starch; whilst the stocks likewise in countries outside Germany were largely reduced owing to the very limited arrivals from this country during the past 12 months. It is stated that numerous new starch and grape-sugar factories are being established in the Prussian provinces of Posen and Westphalia and in some other parts of Germany in view of the profitable results attained by this industry during recent times; but it is rather doubted here whether the increase of consumption in Germany has been large enough to warrant such a sudden development of the production of these articles. With regard to last year's business in potato products at Hamburg itself, the same is said to have been unfavourably affected by the formation of a Dutch syndicate for the sale of potato flour, which will doubtless render German competition difficult. It is furthermore considered doubtful whether the periodical sales recently established in Germany for potato flour and starch may not have a prejudicial influence upon the Hamburg export trade in these articles. The total exports of all kinds of potato products from Germany (as above mentioned), and also from Hamburg alone, were less extensive in 1898 than in the preceding year; but detailed statistical returns of the same are not yet procurable.

Trade of Hamburg in nearly all kinds of dye-woods in 1898 is stated to have been very quiet; the prices of some kinds experienced considerable fluctuations, but the unfavourable condition of the export business to many trans-Atlantic countries prevented Hamburg merchants from deriving profitable results from transactions with those parts. German inland manufacturers suffered much from this unfavourable situation, and importations of the more important sorts of dye-woods last year were, in consequence, less considerable than in 1897. Of Campeachy logwood only 13,700,000 kilos. were imported, as against 17,800,000 kilos. in the preceding year; of Jamaica and St. Domingo logwood 8,100,000 kilos., as against 8,750,000 kilos. in 1897; of Lima redwood, however, the importations amounted to 550,000 kilos., as against 290,000 kilos. in 1897.

Prohibition of Matches made with Yellow Phosphorus in Switzerland.

Foreign Office Annual Series, No. 2271, *May* 1899.

A law was passed on November 2, 1898, prohibiting the manufacture, importation, exportation, or sale, of lucifer matches in the fabrication of which yellow phosphorus is employed. The cessation of their manufacture is to date from April 1, 1900; while their importation is only allowed up to June 1, 1899, as well as that of yellow phosphorus in any form, except for scientific or special purposes, with the permission of the proper authorities. Their exportation or sale in the country will be illegal after January 1, 1901.

Chemical Trade of Japan.

Foreign Office Annual Series No. 2277, *May* 1899.

The imports of cement in 1898 were only 27,952*l*., against 84,444*l*. in 1897, and it seems safe to say that 1899 will see a complete cessation of this trade. New enterprises requiring cement are few, and even works in process of execution are being limited as far as possible. In the meanwhile the native factories have extended their works, and their position now is the exact opposite of what it was a year or so ago, when almost any price could be obtained for cement. Importers have incurred heavy losses in realising their stocks, some of which were sold for less than the cost of freight.

In Japan the consumption of alcohol is very much greater than it was some years ago. In 1895 the imports were valued at 45,927*l*.; in 1896, 52,660*l*.; in 1897, 100,974*l*.; and in 1898, 275,628*l*. Thus, during the past four years the increase has been six-fold. Since the raising of the tax on *saké*, alcohol has come into common use in the manufacture of refined and other kinds of *saké*, some of which are now said to contain as much as 25 per cent. of alcohol. Last year the quantity imported was double that of 1897, but to an extent the reason was the desire to evade the new tariff by bringing in as much as possible before January 1, 1899. On February 14, 1899, the statutory tariff underwent a slight revision, and the duty on alcohol imported from abroad was fixed at 250 per cent. *ad valorem*. This cannot fail to check the growth of the import trade.

Alcohol was, as usual, obtained chiefly from Germany. The United States come next with about one-sixth of the amount brought from Germany, and more than 20 times the quantity she provided last year. Then came Holland and France, new competitors in this branch of trade.

Table I.

Comparative Table of Principal Imports to Japan during the Years 1898–97.

Articles.	1898.		1897.	
	Quantity.	Value.	Quantity.	Value.
Dyes:—	Tons.	£	Tons.	£
Aniline dyes	808	124 424	640	96,997
Indigo	1,075	231,792	712	160,223
Logwood extract......	678	24,300	805	29,162
Total	..	380,516	..	286,281
Drugs and chemicals:—				
Alcohol	..	275,623	..	100,974
Bicarbonate of soda...	..	14,632	..	12,044
Carbolic acid	..	17,267	..	4,239
Caustic soda	..	43,152	..	23,915
Chlorate of potash	..	64,338	..	51,840
Phosphorus amorphous	..	30,447	..	29 232
Salicylic acid	..	26,224	..	12,494
Total	..	471,683	..	234,738

Table II.

Comparative Table of Principal Exports from Japan during the Years 1898–97.

Articles.	1898.		1897.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£	Tons.	£
Camphor	1,448	121,546	1,552	133,899
Gall nuts	..	12,478	..	10,007
Menthol crystals........	..	10,841	..	13,089
Pepermint oil	..	5,313	..	5,663
Mining products—				
Antimony	1,327	22,111	1,516	27,176
Coal........	2,186,790	1,548,482	1.103,012	1,172,619
Copper	16,323	741,848	13,831	586,704
Manganese	9,965	15,958	14.524	29,852
Sulphur..............	12,527	48,695	9,120	·32,635
Total	..	2,377,094	..	1,839 986

Morphia at Amoy, China.

Foreign Office Annual Series, No. 2281, *June* 1899.

Last year the consumption of morphia increased some 2,000 ozs. and appears to find considerable favour with the Chinese, for the import has risen in three or four years to over 11,000 ozs. A great deal is taken in the form of pills, but hypodermic injection is also common. It is also frequently sold as a cure for the opium habit. The retail price is about 3 dols. per oz.

Manganese and Cement at Rio Janeiro.

Foreign Office Annual Series, No. 2284, *June* 1899.

There is an increase in the movement of the recently-established mining industry of manganese ore, the quantity of ore exported from Rio de Janeiro having this year reached 26,000 tons, as against 15,800 tons during 1897. In last year's report the quantity exported was, by an oversight, returned as 8,800 tons, which was the output of one only of the two local firms engaged in this industry. Of the ore exported in the year 1898, 15,000 tons was sent to the United States, and the greater part of the remaining 11,000 tons was consigned to England.

Belgium is by far the largest supplier of cement, having sent during the year 86,902 casks, France holding second place with 24,845 casks, whilst Great Britain comes third with 13,264 casks, being followed by Germany with 10,210 casks. The preference is still for English Brands, but depreciation of currency has obliged importers to look out for cheaper though inferior makes.

Esparto, Phosphates, &c., in Tunis.

Foreign Office Annual Series, No. 2279, *June*, 1899.

During the year 1897* the total value of esparto or Halfa grass exported from Tunis amounted to 1,818,570 fr. in value, nearly all of which was shipped to the United Kingdom and to Malta. Almost the entire trade is in the hands of one English firm, and this means the spending of a great deal of British money in Tunis. The reason why the French cannot compete with British in the Halfa trade is that the grass can be so much more cheaply made into paper in England than in North Africa or in France. In Great Britain fuel and chemicals are less expensive, and can be obtained close to the paper mills. Local manufacture of paper in Tunis, or even Algeria, is rendered still more difficult by the comparative scarcity of running water.

Nevertheless, various projects are on foot for establishing factories in Tunis which shall both turn the Halfa into paper, and extract from it the relatively large proportion of alcohol which this grass contains.

The mines of zinc and lead in Tunis are being worked with increased energy, and it is stated that a considerable proportion of the zinc is sent to England.

The country is rich in phosphates: besides the mines beyond Gafsa, phosphates have been discovered in the hills south of the railway, between the 110th and 115th kiloms. Zinc has been discovered in these hills, and is being worked to a small extent, though it has not yet been possible to ascertain whether it exists in any great quantities.

The phosphate Company have contracted to export a minimum of 250,300 tons of phosphates per year. It is estimated that at least 300,000 tons will be exported, which will necessitate the departure of three steamships per week, the majority of which will sail under the British flag. The railway runs down to the port at Sfax alongside the quay, where a huge shed has been erected for the purpose of storing the phosphates. Although these phosphates may be considered as a cheap article, the experiments made in the north of Tunis have proved so satisfactory that there is little doubt that the company will derive considerable benefit from the concession, and the importance of the port of Sfax will be greatly increased.

Conditions and Prospects of British Trade in certain American Countries.

T. Worthington.* *Govt. Report, Part VI., Uruguay.

(See this Journal, April 1899, 418.)

Alkali.

Soap makers here prefer caustic soda to soda ash. The figures of imports for three years, in tons of 1,000 kilos., are as follow :—

Imports of	1895.	1896.	1897.
	1,000 kilos.	1,000 kilos.	1,000 kilos.
Soda ash	460	493	328
Caustic soda	824	437	487

The figures here given for soda ash are those which appear in the statistics under the head of "soda comun," which includes soda crystals, but, as regards 1897 at least, there seems reason to doubt their accuracy, as will appear lower down. The under-mentioned quantities of "soda comun" were imported from Germany, France, and Italy respectively in 1896 and 1897.

——	1896.	1897.
	Kilos.	Kilos.
Germany	150	5,195
France	None	32,660
Italy	9,920	16,500

Caustic soda, however, all comes from England, except a small quantity received from the Argentine, which is also doubtless of British manufacture.

Soda crystals are imported from England. A leading importer in 1897 received about 64 tons, and he estimates his import at about one-fourth the total, or say 256 tons, which would leave only 72 tons out of the 328 tons of "soda comun" stated in the statistics as the quantity of soda ash imported in that year.

Bicarbonate of soda (English and a little German) is imported to only a small extent.

Only a trifling business is done in *chloride of lime:* 1,740 kilos. were imported in 1897—1,080 kilos. from England, and 660 from France.

Soap and Candles.

Fancy soap is largely French, but common soap is almost all made in the country. Of the small importation of the latter article, namely, 45 tons in 1895, 38 tons in 1896, and 42 tons in 1897, about two-thirds came from Italy and Spain. The soap and candle factory is about six miles from the centre of the city of Monte Video, with plenty of ground, but no railway or water communication. Except some English presses and four or five boiling pans, some of which are for direct heat only, and others heated partly by steam coils, the machinery is chiefly French. There are two large tubular boilers, three distillers, a small steam engine, and dynamo for the electric light. There is a brick chimney 41 m. high, and an artesian well 160 m. deep. The total capital invested in the concern is stated at 112,000 dols.

The tallow is native. The sulphuric acid comes from France; the caustic soda, of which about 250 to 300 drums per annum are used, and the soda ash, about 50 barrels per annum, come from England. Talc for the soap is from the south of France, and the cotton wick, of which about 100 kilos. are used monthly, is also from France. It is prepared so that when the candle is blown out it goes out altogether, leaving no part smouldering. Without this preparation the wick only costs 2·80 francs per kilo.

The stearin candles, which are of several sizes—and some of which are hollow—are always put up in cardboard packets of four candles, 25 of such packets being packed in the wooden boxes. A certain proportion of these candles are packed under foreign names, which some buyers insist on having. The composite candles are packed direct, 500 in a wooden box. The production is from 18,000 to 20,000 boxes of stearin, and about 1,200 boxes of composite candles. The glycerin, which is extracted prior to distillation of the tallow and sulphuric acid, is shipped to Europe in old petroleum tins. The soap is put up in boxes of 50 kilos. each and about 70,000 kilos. are made per month.

Only about 25 hands are employed in this factory.

Caoutchouc, Manufacture of.

India-rubber sheets come chiefly from England, but Italy is now competing. Of tubes, the number of kilos imported from the United Kingdom, Germany, Belgium, and Italy for three years are :—

Countries whence Imported.	1895.	1896.	1897.
	Kilos.	Kilos.	Kilos.
United Kingdom	2,077	1,643	1,216
Germany	1,340	1,565	383
Belgium	525	150	180
Italy	165	1,353	928

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* No statistics for 1898.

Cement.

English cement is admitted to be the best, and such as is indispensable for hydraulic work, but the largest import is of Continental cement. A large importer sold one barrel of English at 2·80 dols. per barrel (of 120 kilos. gross) to 10 barrels of Continental at 2·10 dols. The latter was good enough for building purposes, mixing with plaster, &c., and he did not see why English manufacturers should not make a special quality to compete, though he had not been able to persuade them to do so. The following figures show the imports here from the principal countries, *viz.* (in tons of 1,000 kilos.) :—

Countries whence Imported.	1895.	1896.	1897.
	1,000 kilos.	1,000 kilos.	1,000 kilos.
United Kingdom	1,415	1,359	1,694
Germany	1,949	821	724
Belgium	1,320	1,980	900
France....................	1,132	978	1,343
Sundries, including Argentine.	476	328	207
Total	6,292	5,466	4,868

Chemical Products and Dyestuffs.

Acids come chiefly from the Continent, owing, apparently, to the greater facility for obtaining cheap freights thence, on this class of product than from England. The figures, in thousands of kilos., are :—

Countries whence Imported.	1895.	1896.	1897.
	1,000 kilos.	1,000 kilos.	1,000 kilos.
Germany	89·7	100·3	44·6
United Kingdom	13·3	9·2	15·7
France	6·2	31·9	17·5
Belgium	7·6	9·7	3·0
Argentine Republic........	7·6	5·1	0·3
Sundries..................	Nil	0·7	0·1
Total	124·4	156·9	81·2

Sulphuric acid forms the bulk of the above imports, but nitric and hydrochloric acids have for some time past been imported in greater quantities than formerly.

Sulphate of copper forms but a small import; the following figures, in 1,000 kilos., show who are the competitors :—

Countries from which Imported.	1895.	1896.	1897.
	1,000 kilos.	1,000 kilos.	1,000 kilos.
United Kingdom	115	91	55
Germany	13	40	15
United States..............	10	33	23
France	Nil	8	Nil
Italy	Trifle	Nil	13
Sundries, including Argentine transhipments.	1	3	Nil
Total	139	175	106

Gelatin, used for stiffening the juice in packing ox tongues, is largely of German manufacture. German makers put it up as required in half-ounce tablets, one of which just suffices for a tin; English makers will not make it up in these small tablets, nor make the cheap quality required.

Oilcloth.

About four-fifths of this appears to come from England, but German competition is felt. A sample of German oilcloth, which the importer considers of excellent quality, and better than English at the same price, has been forwarded to London.

Seed Oil.

The import of this oil, which is almost all from England, only supplies part of the demand, as the oil is produced locally from native linseed. One of the oil mills had four English presses of about 400 tons each, a 12 horse-power engine, and a German filter. The manager reported that they had no difficulty in getting seed, and could make far more oil than they could sell. They had shipped as much as 300 to 400 tons of oil-cake in a year. Importers say the native oil was made very well at first to get the trade, then it gradually fell off in quality until the imports came freely again, and that now its quality is again improving. A recent sale of English oil was made at 4.50 dols. per drum, while the price of the native article is somewhere about 3.60 dols. per drum.

Painters' Colours and Materials.

Over 60 per cent. of the paints which come to this market (the great bulk of which are in the form of paste, packed in drums) appear to be British, the remainder being divided between Italy, Belgium, France, and Germany. There is stated to be a large syndicate of paint manufacturers in Genoa, who pack paints under any mark or ticket buyers require. Varnish was still in (1897) more than half British.

Paper, other than Hangings.

Printing paper, over 87 by 51 cm., comes in at a duty of 15½ per cent. on a valuation of 14 cents. per kilo., whilst writing paper and envelopes pay 38½ per cent. on a valuation of 40 cents. per kilo., so that the great bulk of paper, whether for printing or writing, is imported in large sheets, which are cut up here for the latter purpose. The figures of imports of printing paper (and cover paper for any purpose provided it can pass as printing paper) are, in thousands of kilos :—

Countries whence Imported.	1895.	1896.	1897.
	1,000 kilos.	1,000 kilos.	1,000 kilos.
Germany	545	671	585
Belgium	213	510	377
United Kingdom	170	207	113
France	44	24	36
Italy	6	40	72
United States..............	4	19	6
Argentine Republic.........	50	110	74
Total	1,032	1,581	1,263

Printing paper, properly so called, comes principally, if not exclusively, from the Continent. One of the largest importers of paper here spoke of the readiness of the German makers to meet their customers at all points, *e.g.*, to make alterations in detail of finish or packing, not to stick to a hard and fast rule as to minimum quantities, &c., and even in the matter of credit.

Paper for wrapping and packing of all kinds is the next most important division. In this trade, at least in common kinds, Italy has by far the largest share. A little is produced locally.

Matches.

Only wax matches are used, and they are all made in the country. The consumption is estimated at 18,000 to 20,000 gross boxes (containing an average of 35 matches each) per month. The matches are almost all put up in cardboard boxes, but a factory has just been erected to work a patent for little tin boxes, which will enable the latter to be sold very cheaply. A similar factory is about to be erected in the Argentine, the machinery for which is mostly German, with some Italian.

PETROLEUM TRADE IN RUSSIA IN 1898.

U.S. Cons. Reps., 1899, **60**, *No.* 225, 209—229.

This report deals with the oil trade of the Bibi-Eibat, Balakhani-Sabunchi, and Romani districts, and from the tables of statistics appended to the report there appears to be no falling off in the production of oil, although generally it is necessary to bore more deeply than heretofore. The sanguine views of the trade last year that the consumption of residuum or oil fuel would continue to increase and the price consequently advance, were fully confirmed by results. These views were based on the fact that coal at its present price cannot possibly compete with residuum as fuel in the manufacturing districts contiguous to the Volga, the centre of which is Moscow. The value of petroleum fuel as compared with coal for purposes of steam raising is well established in Russia, and, taking into account the steady increase of her manufacturing industries, it is probable in the opinion of the compiler that the demand of oil for purposes of fuel will not be met by a corresponding increase of crude oil; consequently higher prices for residuum and crude oil are anticipated.

Residuum having the first place in the consideration of the oil trade, illuminating oil is regarded as of minor importance. Owing to the uncertainty of the cost of freightage from Baku to Batum it is hazardous for exporters to do business more than a month in advance. The outlook for this year is no better than that of last, and, unless there should be a very marked advance in the price of refined oil in the foreign markets, even with an important increase in crude production, there is little hope of profitable export. In this connection it is interesting, to note that a pipe line (for refined oil) on the American principle, is being constructed from Baku to Batum.

The following tables show the output (in gallons) of all products in Baku in 1897–8, and also the exports for the same period :—

Output.

Year.	Illuminating.	Lubricating.
1898	473,205,000	52,105,000
1897	458,035,000	45,860,000

Year.	Residuum.	Crude.	Total.
1898	1,211,805,000	219,460,000	1,956,575,000
1897	1,127,100,000	130,045,000	1,761,040,000

Shipments.

Year.	Crude and Residuum.	Lubricating Oil.
1898	13,464,865	39,844,740
1897	11,247,820	34,012,645

Year.	Illuminating Distillate.	Refined Oil.	Total.
1898	30,673,240	263,765,690	347,748,535
1897	39,246,950	248,649,845	333,157,260

Shipments to Great Britain.

Year.	Crude and Residuum.	Lubricating Oil.	Illuminating Distillate.	Refined Oil.	Total.
1898	2,634,475	10,601,800	4,321,665	41,572,465	54,358,745
1897	2,116,810	8,518,810	13,646,660	23,485,345	43,974,760

From these figures it will be seen that the consumption of oil in Russia is in a greater ratio for the two years 1897–1898 than the exports, and, as her home manufactures involving the use of residuum as fuel increase, so will her export trade in petroleum products decrease.—J. L. B.

GENERAL TRADE NOTES.

The Supply of Cinchona Bark.

Imp. Inst. J., June 1899, 156.

The report that there will be a decrease in the output of the Ceylon and Indian cinchona plantations during the present year has given rise to considerable interest in cinchona statistics in commercial circles.

It appears that during the last few years the supply of cinchona has only just kept pace with the demand, and has now fallen short of it, so that a still further increase in the price of the bark and the alkaloid may be looked for. This enhanced value of cinchona may possibly lead to an extension of cinchona-planting in India, where planters have, of late years, shown a tendency to abandon it in favour of more profitable products. (*Imp. Inst. Journ.*, IV., p. 77.)

The following tables show the amounts of cinchona produced in the East Indies during the last few years, and the imports into the chief cinchona-consuming countries :—

Exports.

——	1896.	1897.	1898.
	Lb.	Lb.	Lb.
Ceylon	1,328,498	591,368	975,784
British East India	754,384	816,077	3,090,060
Java	11,079,234	9,349,687	12,303,424

Imports.

——	1896.	1897.	1898.
	Lb.	Lb.	Lb.
United Kingdom	3,952,000	2,758,000	5,143,000
Holland	10,922,000	9,070,000	11,657,000
Germany	7,649,000	9,279,000	7,805,000
France	2,603,000	2,270,000	2,304,960
United States	2,599,000	2,696,000	3,302,128

It is difficult to correctly estimate the amount of quinine produced in any country, since some of the cinchona imported is used in other ways, but the following tabular statement has been given as probably representing the world's production of quinine last year :—

	Oz.
Germany	7,594,000
United States	3,333,000
France	1,424,000
United Kingdom	1,500,000
Java and other countries	1,000,000

Fumigation of Trees with Hydrocyanic Acid.

Standard Agric. Reps., June 13, 1899.

Fumigation with hydrocyanic acid gas for the destruction of insects on fruit trees and bushes has been carried out upon a considerable scale by Prof. W. G. Johnson, State Entomologist for Maryland. In a bulletin issued from the Maryland Agricultural Experiment Station last Autumn, a great number of experiments in fumigation were described and illustrated. Hydrocyanic acid gas is used chiefly for the destruction of scale insects, including the dreaded San José scale, for which it is effective, without injuring the fruit trees or their foliage when it is properly administered. Prof. Johnson finds that one-fifth of a gramme of cyanide of potassium per cubic foot of space enclosed is the best quantity for deciduous trees; and in all cases he uses 50 per cent. more sulphuric acid than cyanide, and 50 per cent. more water than acid. The acid is first put into a jar, which is placed in the required position inside the inclosure to be fumigated; next the water is poured in; and lastly, the cyanide of potassium, bag included, is dropped into the jar, the operator instantly retiring and closing the box, tent, or hothouse, which should remain closed for half an hour. The materials must be the purest of their kinds that can be obtained. An important caution is to the effect that the fumigation should never be done while the sun is shining, but only at night or on cloudy days. But until numerous trials on a small scale have enabled experts to lay down strict rules as to the quantities of cyanide of potassium that can be safely used for various plants, growers must be advised to refrain from dealing with this dangerous poison.

SUPPLIES OF FOREIGN HEAVY CHEMICALS IN THE UNITED STATES.

***Eng. and Mining J., May* 27, 1899.**

Article.		Imports.		Exports.		In Warehouse, Dec. 31st.		Consumption.	
		1898.	1894.	1898.	1894.	1898.	1894.	1898.	1894.
Bleaching powder	Lb.	108,462,825	96,256,251	28,805	19,943	185,660	..	108,248,623	96,236,308
Soda ash	„	67,373,939	295,826,589	4,244,073	99,886	979,961	3,069,672	62,747,305	292,676,031
Sal soda	„	5,000,768	25,474,285	1,272	2,000	..	..	5,089,406	25,472,285
Caustic soda	„	24,381,873	44,772,512	1,267,237	2,929,473	1,214,836	1,127,980	22,529,780	40,715,059
Chlorate of potash	„	4,806,402	4,599,069	25,170	4,499	41,738	..	4,739,314	4,595,470
Total	„	211,315,810	466,929,606	5,558,957	3,055,801	2,422,135	4,188,652	203,454,718	459,685,153

CHEMICAL INDUSTRIES IN RUSSIA.

***Ch. of Com. J., June* 1899, 106.**

When the last official census of industrial undertakings was taken (1895), the chemical factories numbered 734, with an annual production valued at 65,723,000 roubles, and employing 43,527 hands: these totals compare with 734 factories, 28,300,000 roubles for production, and 26,089 hands on the computation of 1890. The Secretary of the French Embassy at St. Petersburg, in a report on the soda and chloride of lime industry in particular, says in 1895 the production of soda (expressed in carbonate of soda at 100 per cent.) was returned at 2,985,000 poods, but since that year the progress has been so rapid that the present production exceeds 5,300,000 poods. Caustic soda, he avers, is on the point of having its production augmented in a notable proportion by the creation of a new factory which will treat the brine by the process of electrolysis. As to imports, the Secretary furnishes the following data:—

Articles.	1896.		1897.	
	Poods.	Roubles.	Poods.	Roubles.
Soda and potash	636,475	1,341,011	873,000	1,382,000
Bicarbonate of soda and potash.	77,655	217,936	88,000	[illegible]
Caustic soda and potash.	449,607	1,136,355	468,000	[illegible]
Chloride of lime	257,000	375,000	274,000	[illegible]

The text of the report from which the foregoing statements are taken may be seen on application at the Information Department of the London Chamber.

CAPE IMPORTS IN 1898.

***Chem. and Druggist, June* 24, 1899, 988.**

The report of the Chief Collector of Customs for Cape Colony shows the total imports to have reached the value of 15,264,949*l*., fully a million less than in 1897. The following are the items which most interest the chemical trades:—Drugs and chemicals, 307,498*l*. (15,630*l*. more); dynamite and blasting compounds, 2,442,835 lb. (3,739,147 lb. less), value 115,170*l*.; linseed and paint oils, 146,843 galls. (decrease, 2,770 galls.), value, 12,922*l*.; paints, turpentine, and varnish valued at 65,691*l*.; photographic materials, 23,944*l*.; sheep-dip, 43,002*l*. (14,680*l*. less); soap, 13,221,657 lb. (increase 852,868 lb.), value, 103,185*l*.; flowers of sulphur, 12,684 cwt., value, 5,370*l*.; wax, paraffin and stearin, 1,769,649 lb., value, 15,827*l*. Of the 307,498*l*. of drugs and chemicals 17,701*l*. went to the Orange Free State, 555*l*. to Basutoland, 378*l*. to the Bechuanaland Protectorate, 121,016*l*. remained in Cape Colony, 8,932*l*. went to the Zambesi, and 158,916*l*. to the Transvaal.

DRAWBACK IN MEDICINAL TINCTURES.

***Chem. and Druggist, June* 24, 1899, 1014.**

The export of medicinal tinctures, &c., under the drawback arrangements continues steadily to increase. For the quarter ended March 31st last duty on 23,074 galls. of proof spirit in these mixtures was refunded by the excise, an increase of 3,570 proof gallons over the corresponding quarter of last year. For the financial year ended March 31st drawback was allowed on 78,154 galls. of proof spirit, as against 67,519 galls. in the preceding year, and 56,999 galls. in the year ended on March 31st, 1897, showing an average increase of more than 10,000 galls. annually. Considerable progress is being made in the compilation of the additional list of tinctures and medicinal preparations on which the loss allowances are to be made, and no doubt a further increase of the exports will be promoted of its issue.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st May.	
	1898.	1899.
	£	£
Metals	1,797,374	2,620,090
Chemicals and dyestuffs	442,359	424,822
Oils	564,129	768,183
Raw materials for non-textile industries.	3,609,859	4,435,092
Total value of all imports	37,706,378	40,876,828

SUMMARY OF EXPORTS.

Articles.	Month ending 31st May.	
	1898.	1899.
	£	£
Metals (other than machinery)	2,733,843	3,578,153
Chemicals and medicines	667,962	870,275
Miscellaneous articles	2,825,138	3,178,220
Total value of all exports	17,891,354	23,030,240

IMPORTS OF RAW MATERIAL FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 31ST MAY.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Bark, Peruvian	Cwt.	4,069	3,485	9,540	8,443
Bristles	Lb.	280,753	210,191	31,516	27,503
Caoutchouc	Cwt.	37,812	42,325	416,942	602,066
Gum:—					
Arabic	„	6,650	4,557	10,526	12,125
Lac, &c.	„	4,859	13,972	15,572	46,770
Gutta-percha	„	7,338	4,644	68,710	61,103
Hides, raw:—					
Dry	„	44,955	46,342	119,871	124,323
Wet	„	46,178	49,917	95,184	108,951
Ivory	„	723	535	27,224	21,796
Manure:—					
Guano	Tons	1,538	4,250	10,324	18,150
Bones	„	4,496	3,703	18,333	15,988
Nitrate of soda	„	17,147	22,306	126,535	173,821
Phosphate of lime	„	22,788	41,420	31,967	61,173
Paraffin	Cwt.	52,104	96,027	43,726	88,434
Linen rags	Tons	1,667	1,885	15,690	15,857
Esparto	„	9,620	15,899	37,832	59,313
Pulp of wood:—					
Chemical	„	15,536	19,587	98,175	136,491
Mechanical	„	14,294	15,767	40,402	38,283
Rosin	Cwt.	126,796	94,749	28,389	23,904
Tallow and stearin	„	173,542	189,724	177,942	219,519
Tar	Barrels	6,798	2,054	3,673	1,608
Wood:—					
Hewn	Loads	144,969	222,162	320,087	414,837
Sawn	„	313,067	351,511	792,473	867,565
Staves	„	7,269	8,692	41,794	63,729
Mahogany	Tons	4,982	3,354	45,993	33,303
Other articles	Value £	..	..	981,419	1,189,837
Total value		..	..	3,609,859	4,435,092

Besides the above, drugs to the value of 102,773*l*. were imported, as against 81,807*l*. in May 1898.

Imports of Metals for Month ending 31st May.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Copper :—				
Ore .... Tons	4,911	7,386	60,591	135,031
Regulus .... ,,	7,053	7,410	187,882	273,237
Unwrought ..... ,,	5,440	4,765	288,107	367,996
Iron :—				
Pig .... ,,	8,527	14,596	29,565	51,232
Ore .... ,,	426,031	672,668	314,514	493,335
Bolt, bar, &c. ... ,,	4,632	4,374	37,043	32,479
Steel, unwrought .. ,,	3,191	11,017	18,267	62,024
Lead, pig and sheet ,,	17,273	17,523	241,072	245,175
Pyrites .... ,,	62,697	59,357	106,219	103,603
Quicksilver .... Lb.	63,260	429,558	6,235	45,530
Silver ore....... Value £	..	..	79,460	107,030
Tin .... Cwt.	37,862	50,559	121,606	282,335
Zinc............... Tons	6,788	6,175	119,730	156,818
Other articles ...Value £	..	..	187,083	264,265
Total value.........	..	..	1,797,374	2,620,090

Imports of Chemicals and Dyestuffs for Month ending 31st May.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali............. Cwt.	19,623	33,919	10,394	16,776
Bark (Tanners', &c.) ,,	32,732	30,040	12,040	13,866
Borax .... ,,	96	594	110	318
Brimstone .... ,,	20,216	40,266	4,789	10,141
Chemicals...... Value £	..	..	113,574	113,366
Cochineal .... Cwt.	883	37	5,127	221
Cutch and gambier Tons	1,940	1,680	28,784	30,999
Dyes :—				
Alizarin.......Value £	..	..	49,845	39,202
Anilin and other ,,	..	..	20,196	18,717
Indigo .... Cwt.	2,938	1,281	35,321	17,888
Nitrate of potash.. ,,	24,782	18,038	18,425	12,798
Valonia .... Tons	1,340	1,353	13,396	16,408
Other Articles...Value £	..	..	130,358	134,122
Total value.........	..	..	442,359	424,822

Imports of Oils for Month ending 31st May.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Cocoa-nut....... Cwt.	25,626	27,270	30,609	33,075
Olive............ Tuns	1,888	1,783	62,390	61,116
Palm .... Cwt.	66,081	107,059	70,107	117,308
Petroleum ...... Gall.	12,785,918	19,839,704	227,354	344,127
Seed............ Tons	2,876	4,254	52,677	78,436
Train, &c. ...... Tuns	551	941	13,213	17,249
Turpentine ..... Cwt.	16,216	23,771	19,905	39,427
Other articles Value £	..	..	87,874	77,445
Total value	..	..	564,129	768,183

Exports of Drugs and Chemicals for Month ending 31st May.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali .... Cwt.	321,355	360,315	87,030	94,256
Bleaching materials ,,	91,074	108,869	24,388	26,226
Chemical manures Tons	25,980	31,672	131,660	189,162
Copper sulphate .. ,,	6,592	7,581	88,508	179,942
Medicines....... Value £	..	..	230,154	100,510
Other articles... ,,	..	..	667,962	280,179
Total value	..	..	106,222	870,275

Exports of Metals (other than Machinery) for Month ending 31st May.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Brass............. Cwt.	7,770	9,493	35,074	46,574
Copper :—				
Unwrought.... ,,	46,004	62,478	124,453	235,933
Wrought ...... ,,	24,203	18,661	75,810	77,244
Mixed metal... ,,	14,066	8,624	34,264	29,340
Cutlery ....Value £	..	..	39,032	50,219
Hardware........ ,,			118,214	133,484
Implements...... ,,	..	..	103,264	122,203
Iron and Steel ... Tons	293,641	374,374	1,914,913	2,575,155
Lead............. ,,	4,873	6,026	66,759	90,722
Plated wares... Value £	..	..	28,811	32,174
Telegraph wires.. ,,	..	..	41,944	31,377
Tin .... Cwt.	14,719	8,008	50,016	46,739
Zinc .... ,,	17,112	10,394	14,399	12,663
Other articles...Value £	..	..	86,390	94,276
Total value	..	..	2,733,343	3,578,153

Exports of Miscellaneous Articles for Month ending 31st May.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Gunpowder..... Lb.	330,500	659,500	6,012	17,248
Military stores.. Value £	..	..	233,388	85,270
Candles......... Lb.	1,649,900	2,804,900	23,142	40,292
Caoutchouc..... Value £	..	..	113,659	127,560
Cement......... Tons	25,955	36,413	48,196	70,317
Products of coal. Value £	..	..	141,592	164,242
Earthenware ... ,,	..	..	130,452	163,939
Stoneware ...... ,,	..	..	17,779	18,149
Glass :—				
Plate .... Sq. Ft.	175,158	171,351	7,575	10,859
Flint .... Cwt.	8,399	6,775	18,058	17,806
Bottles .... ,,	67,594	80,944	31,880	39,221
Other kinds ... ,,	21,773	22,106	17,824	20,602
Leather :—				
Unwrought .... ,,	13,120	13,467	113,734	130,262
Wrought......Value £	..	..	28,492	33,292
Seed oil .... Tons	4,046	3,397	69,019	63,944
Floorcloth.......Sq. Yds.	2,095,400	2,555,800	87,635	108,421
Painters' materials Val. £	..	..	146,130	171,921
Paper............. Cwt.	83,800	78,715	124,781	127,364
Rags.............. Tons	5,526	5,876	27,562	26,171
Soap .... Cwt.	82,306	89,901	73,715	88,709
Total value	..	..	2,825,138	3,178,220

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

10,181. G. Bestwick. Improved means for preventing radiation of heat from boilers, pipes, and the like. May 15.

10,204. A. G. Brookes.—From F. Lorenz, successor to J. Lutjens, Germany. A new or improved process and apparatus for simultaneously drying and feeding, or conveying superphosphate and other materials. Complete Specification. May 15.

10,315. A. W. Cramp. Improvements in connection with appliances for periodically interrupting the supply of gas, and for analogous purposes. May 16.

10,324. C. V. F. Ludwig and G. Cramer. Improvements in filtering apparatus. Complete Specification. May 16.

10,335. W. P. Thompson.—From The Ransom Gas Machine Company, United States. Improvements in carburetting apparatus. Complete Specification. May 16.

10,404. W. Mather. Improved means for evaporating substances, and reducing them to an anhydrous condition. May 17.

10,695. E. Lambert. *See* Class VII.

10,771. J. Carter, C. Carter, and O. Carter. Improvements in kilns and ovens. May 23.

10,787. C. Timmann. Smokeless furnace. May 23.

10,883. O. P. Ostergren. Improvement in receptacles for holding and storing liquids, more particularly liquid air or other liquefied gases. Complete Specification. May 24.

10,885. L. Herlitschka. Improvement in centrifugal separators. Complete Specification. May 24.

10,964. F. A. Anderson. Improvements in apparatus for making solutions. May 25.

11,018. L. Rivière. Improvements in integrator evaporator apparatuses for the treatment of liquids; particularly applicable in the manufacture of sugars, soaps, fatty substances, and the like. May 26.

11,124. J. Mecredy. Improvements in apparatus for concentrating or drying liquid or semi-liquid substances by evaporation. May 27.

11,243. E. C. Hargrave. Improvements in the utilisation of liquefied air or gas for cooling or refrigerating purposes. Complete Specification. May 30.

11,399. J. McNeil. Improvements in evaporating apparatus. June 1.

11,440. J. Buss. An improved process and apparatus for concentrating and separating ores and other substances. June 1.

11,593. J. Keith. Improvements in gas or air compressors or pumps. June 5.

11,649. A. J. Boult.—From F. Correll, Germany. Improvements in or relating to the drying, heating, cooling, or impregnating of granular and other material, and apparatus therefor. Complete Specification. June 5.

11,719. J. E. Thornton and C. F. S. Rothwell. Improvements in coolers, condensers, radiators, geysers, and the like apparatus. June 6.

11,771. L. Baggett. Improvements in apparatus for expressing liquids from solids. Complete Specification. June 6.

11,893. R. W. James.—From E. Zimmermann and E. Mégret, France. Improvements in carburetting appliances. June 7.

11,894. W. Smethurst. Improvements in and relating to furnaces for the treatment of refractory and other ores and minerals, animal and vegetable refuse, or similar material, and the recovery therefrom of by-products. June 7.

12,075. T. Cole and W. L. Cole. Improvements connected with apparatus for producing cold air for refrigerating and like purposes. June 9.

12,184. S. E. Alley and D. Mathieson. Improvements in apparatus for evaporating, condensing, or heating feed-water. June 12.

12,195. W. L. Spence. Improvements in or connected with air or other gas-heating furnaces and kilns. June 12.

12,223. W. R. Wood. Improvements in combustion furnaces. June 12.

12,311. J. G. Lemon and A. E. Lamkin. Apparatus for heating air. June 13.

12,361. D. Boyle. Improvements in carbonating apparatus. Complete Specification. June 14.

12,459. J. McNeil and C. McNeil. Improvements in evaporating or concentrating apparatus. June 15.

12,508. M. Waissbein. Improvements in the distillation of solid and liquid matters. June 15.

12,515. G. Selle. Improvements in the manufacture of selective colour light filters for photo-optical purposes. June 15.

Complete Specifications Accepted.

1898.

5038. H. K. Bamber. Special heating apparatus with regulated draught, for drying gypsum and certain other products at a regulated temperature. June 7.

12,181. L. C. Reese. Distilling apparatus. May 31.

12,750. H. H. Lake.—From The firm of N. O. fu Alessandro, Italy. Evaporating and distilling apparatus for use on board ship. June 14.

13,463. T. W. Bloxam. Apparatus for supplying liquids in proportion to each other. June 7.

15,489. C. Erith. Dryers for granular pulverulent and pasty materials, and the like. May 25.

16,100. A. J. Boult.—From H. J. Peron, Belgium. Liquid fuel furnaces. June 21.

16,594. H. Lyon and J. B. Talbot-Crosbie. Refrigerating apparatus. June 7.

18,442. J. C. Montgomerie. Filter presses. June 21.

1899.

4831. H. F. J. Weijers. Combined kiln and drying oven. June 21.

6030. J. Wetter.—From P. F. E. Freundlich, Germany. Shaft furnaces and kilns for the treatment of ores, ceramic, and other materials. May 25.

7066. D. Young.—From The Vaughan Machine Company, United States. Leaching apparatus, especially designed for the leaching of tan-bark. June 7.

II.—FUEL, GAS, AND LIGHT.

Applications.

10,241. O. Imray.—From Oesterreichische Gasgluhlicht and Electricitäts Gesellschaft, Austria-Hungary. Improvements in electrical incandescent lamps with osmium filaments. May 15.

10,248. F. R. Boardman. Improvements in the ignition of gas. May 16.

10,312. C. K. Mills.—From T. A. Edison, United States. Method of and apparatus for re-heating compressed air for industrial purposes. Complete Specification. May 16.

10,327. F. W. Dunlap. Process of and apparatus for eliminating moisture from peat. May 16.

10,332. C. E. Watts. An improved smokeless block fuel. May 16.

10,410. C. K. Mills.—From G. Tabard, France. Improvements in apparatus for generating acetylene gas. May 17.

10,439. A. E. Hodder and J. B. G. Lester. Improvements in or relating to the manufacture and distribution of gas for lighting and heating. May 17.

10,506. W. T. Sugg. Improvements relating to gas lighting. May 18.

10,617. G. Claude. A process for the extraction of oxygen or of super-oxygenated air from atmospheric air. Complete Specification. May 19.

10,685. L. Galicki, J. Lopatin, and P. Lopatin. An improved process for working peat, and manufacturing the same into briquettes. Complete Specification. May 20.

10,705. J. B. de Léry. Improvements in and connected with incandescence gas burners. Complete Specification. May 23.

10,710. T. G. Allen, junior. An improved method of securing an automatically controlled supply of water to the carbide of calcium in acetylene gas generators. May 23.

10,748. J. W. Powers. Improvements in apparatus for generating and storing acetylene gas. Complete Specification. May 23.

10,786. C. Schröder. Improvements in or relating to apparatus for use in the production of acetylene gas. May 23.

10,834. H. Sherwood.—From F. Issels, British South Africa. Improvements in apparatus for generating acetylene gas. May 24.

10,862. P. C. Saule. Improvements in or relating to apparatus for use in the generation of acetylene gas. Complete Specification. May 24.

10,908. W. E. Richards. Improvements in and relating to compositions for combustion as smokeless heat producing media. May 24.

10,909. W. E. Richards. Improvements in and relating to apparatus for containing and burning solid substitutes for alcohol. May 24.

10,983. J. S. Stewart-Wallace, W. B. Cowell, J. R. Paisley, and J. S. K. Welch. Improvements in the manufacture of gas for motive heating and lighting purposes. May 25.

11,041. O. Ernst and A. Philips. The manufacture and production of material for cleansing acetylene gas. May 26.

11,045. W. Widmann. Improvements in and relating to generators for the production of acetylene gas. May 26.

11,056. L. A. Fallot and E. Delaunay. Improvements in acetylene gas generators, and in carbide cartridges for use therewith. Filed May 26. Date applied for Oct. 27, 1898, being date of application in France.

11,116. E. Fenderl. Improvements in and relating to the generation of acetylene gas. May 27.

11,169. Count A. Dillon de Micheroux. Improvements in manufacturing agglomerated fuel blocks. Complete Specification. May 29.

11,274. G. C. Joplin. Improvements in or relating to treating alcohol so as to make it more portable and convenient for burning. May 30.

11,483. The Read-Holliday Acetylene Company, Ltd., W. Cardno, and H. Arundel. Improvements in apparatus relating to the purification of illuminating gas. June 2.

11,494. E. Hilberg. Improvements in and relating to acetylene generators. Complete Specification. June 2.

11,850. D. V. Riordan. Improvements in incandescent gas mantles. June 7.

11,868. N. A. Guillaume. Improvements in apparatus for washing gas. June 7.

11,884. O. Bender and F. Dürst. Acetylene producing machine. June 7.

11,958. B. G. Sinclair and W. S. Woodward. Improvements in and connected with burners for use with liquid or gaseous fuel. June 8.

12,047. A. J. Boult.—From E. Fleischer, Germany. Improvements in or relating to the production of water gas. June 9.

12,053. F. S. Thorn and C. Hoddle. Improvements in apparatus for generating and storing acetylene gas. June 9.

12,077. W. MacKean. A method of marking incandescence mantles. June 9.

12,078. A. Poeffel. Improvements in incandescence lamps for liquid combustibles. June 9.

12,087. A. J. Boult.—From P. Dumont, Switzerland. Improvements in or relating to apparatus for use in the production of acetylene gas. June 9.

12,139. N. A. Guillaume. Improvement in gas generators. June 10.

12,150. J. B. de Léry. Improvements in incandescent gas burners. Complete Specification. June 10.

12,210, B. Haigh. Improvements in burners for acetylene and other gas. June 12.

12,234. H. J. Dowsing and W. S. Hedley. Apparatus for producing artificial sunlight. June 12.

12,295. N. A. Guillaume. Improvements in apparatus for purifying gas. June 13.

12,303. F. G. M. Issels. Improvement in apparatus for generating acetylene gas. June 13.

12,339. A. Rosenthal. Improvements in incandescent gas light burners. June 13.

12,429. A. J. Boult.—From E. Salzenberg, Germany. A process for the production of incandescent gas light. Complete Specification. June 14.

12,485. H. Teichmann. Improved process for obtaining cyanogen combinations from coal gases. Complete Specification. June 15.

12,551. C. M. Walker. A new or improved gas burner for incandescent lighting. June 16.

12,612. W. Elworthy. Improved apparatus for generating ozone. June 16.

12,615. H. Salsbury. Improvements in or relating to acetylene lighting lamps for calcium carbide cartridges. June 16.

12,655. F. Fastré. A new or improved incandescence gas burner. June 17.

12,659. G. Nowak and P. Klemm. Acetylene generator. Complete Specification. June 17.

COMPLETE SPECIFICATIONS ACCEPTED.

1898.

11,377. T. R. Fowler. Apparatus for the manufacture of acetylene or the like. May 31.

11,799. E. Rischgitz. Treatment of peat. May 25.

11,974. R. Cremer.—From L. J. Dorenfeld, Germany. Apparatus for or in the method of utilising the spent liquor from esparto straw wood pulp and similar mills as fuel. May 3.

12,250. W. P. Thompson. — From The Gesellschaft für Heiz- und Beleuchtungswesen, Germany. Acetylene generator. June 7.

13,185. W. Donaldson. Methods of vaporising inflammable oils and storing the vapour or gas produced at constant pressure, for use in heating, lighting, and gas-motors. June 7.

14,127. H. J. Dowsing. Apparatus for utilising radiant heat. May 31.

14,450. E. Böhm. Means for producing ozone. June 7.

14,567. M. Davoren, J. Belton, and J. Davoren. Manufacture of illuminating gas. June 21.

15,713. J. H. H. Duncan. Manufacture of incandescence bodies suitable for use with gas and other burners. June 21.

15,957. G. Kohl. Manufacture of glow-bodies for incandescence burners. June 7.

15,958. G. Kohl. Manufacture of glow-bodies of incandescence burners. June 14.

16,457. H. R. Berger. Apparatus for generating acetylene gas in a pure state. June 14.

16,903. M. L. J. R. L. de Montais. Acetylene gas generators. June 21.

17,127. J. W. Bailey and J. Clapham. Apparatus for use in generating acetylene gas. June 21.

17,504. G. W. Emmerson. Apparatus for generating acetylene gas. June 21.

17,575. G. Buhlmann. Self-igniting incandescent mantles for gas light. June 21.

18,932. J. Perl. Process for the production of continuous and durable platinum gas-lighting pellets for illuminating gas. June 14.

26,361. O. P. Ostergren and M. Burger. Apparatus for the liquefaction and of aeriform fluids. June 21.

1899.

3577. A. Lenner. Incandescence lamp burners for petroleum and other liquid combustibles. June 7.

7303. T. H. Lewis and Lux Syndicate, Ltd. Apparatus for generating acetylene or other gas generated by the addition of a liquid to a solid, and adapted for use in combination with cycle and other lamps. June 7.

7567. P. Kegel. Valve for carbon dioxide receptacles or reservoirs. June 1.

7877. C. Demuth. Apparatus for generating acetylene. May 25.

8339. K. Küppers and H. Schroeder. Acetylene gas generators. June 14.

8572. J. C. Fell.—From H. B. Cornish, United States. Gasoline gas apparatus for carburettors. June 14.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Application.

12,232. C. Still and The Gewerkschaft König Ludwig. An improved method of recovering by-products in the manufacture of coke. June 12.

Complete Specification Accepted.

1898.

16,045. P. Tack. Apparatus for distilling tar or oil or the like, and for distilling and concentrating other liquid or semi-liquid matters. May 31.

IV.—COLOURING MATTERS and DYES.

Applications.

10,319. J. F. Duke. Improvements in the manufacture of inks. May 16.

10,497. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. Improvements in the manufacture or production of anthraquinone dyestuffs. May 17.

10,709. W. H. Claus and A. Rée. Production or manufacture of black or colouring matters. May 23.

10,775. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. May 23.

10,872. H. E. Newton.—From Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of anthraquinone derivatives. May 24.

11,168. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of naphtophenazonium compounds. May 29.

11,343. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of methyl-α-sulphonic acids of primary aromatic amines and of mixed amido-azo compounds resulting therefrom. May 31.

11,476. G. G. Hepburn. An improved process for the production of azo colours on the fibre. June 2.

11,656. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of brown colouring matters directly dyeing cotton. June 5.

11,804. E. C. Kayser. New dyestuffs. June 6.

11,882. O. Imray.—From F. Sachs, Germany. Manufacture of condensation products from aromatic nitroso- and methylene compounds. June 7.

12,026. W. H. Claus and A. R. Cleyton. Improvements in the manufacture of black colouring matters. June 9.

12,076. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of black colouring matters directly dyeing cotton. June 9.

12,399. R. B. Ransford.—From L. Cassella and Co., Germany. The production of new primary disazo dyestuffs from 2, 3, amidonaphthol 5 sulpho acid. June 14.

12,403. H. Pauly. Manufacture of derivatives of iminotriacetonamine. June 14.

12,614. O. Imray.—From The Farbwerke Meister, Lucius und Brüning, Germany. Improvement in the manufacture of colours developed by chromium compounds on wool fibre. June 16.

Complete Specifications Accepted.

1898.

14,253. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of azo-colouring matters, and materials for use therefor. June 7.

15,708. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of a new product suitable for use as a colouring matter. June 7.

15,709. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of new colouring matter. June 7.

16,564. G. W. Johnson.—From Vereinigte Chininfabriken Zimmer and Co., Gesellschaft mit Beschränkter Haftung, Germany. Manufacture and production of diquinone carbonic ether. June 14.

16,650. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of azo-colouring matters, and materials thereof. May 25.

18,506. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of new substantive azo-colouring matters. June 21.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

10,825. G. W. C. Kirkham. The producing of a silk-like surface upon webs of cotton or wool or other materials not being silk. May 23.

10,875. A. J. Boult.—From E. Rheinbach, Germany. Improved fabric particularly applicable for use as a lining material. Complete Specification. May 24.

10,936. J. F. Copley, P. S. Marshall, and R. Heaton. Improvements in machines for mercerising hanks of yarn. May 25.

10,943. J. S. Lord and G. S. Lord. An improved machine for mercerising, sizing, or dyeing yarns, and for like uses. May 25.

11,122. C. A. Rigault. A process for the chemical decortication of ramy, flax, hemp, jute, alfa, and phormium and other fibres. May 27.

11,156. S. Lorentz. Improvements in the method and apparatus for the production of yarn rovings or slubbings. May 29.

11,321. A. MacFarlane. An improved process for producing artificial textile fibres or filaments in imitation of silk and the like. May 31.

11,544. A. D. Elbers. Improvements in processes of manufacturing mineral wool, also called "slag wool" and "silicate cotton." Filed June 2. Date applied for Nov. 19, 1898, being date of application in United States.

11,772. W. Erben. Improvements in extracting grease from wool, and in apparatus therefor. Complete Specification. June 6.

11,904. J. T. Pearson. Improvements in and relating to the method of and means for moistening or conditioning yarn or other fibrous substances. June 8.

12,300. P. S. Marshall. Improvements in apparatus for mercerising vegetable fibres. June 13.

12,405. F. Hickman and The French-Hickman Flax Fibre Company, Ltd. An improvement in the manufacture of flax pulp. Complete Specification. June 14.

12,550. L. Rivett and S. Oldham. Improvements in and in apparatus for use in mercerising or imparting lustre to yarns or threads. June 16.

12,556. C. Logan.—From C. H. Hubbell, United States. Improvements in and relating to mineral wool. Complete Specification. June 16.

Complete Specifications Accepted.

1898.

11,419. E. Ungnad. Treatment of fibres, yarns, and fabrics to imitate silk. May 25.

12,837. J. S. Bottomley and S. C. R. Gauntlett. Manufacture of an improved yarn. June 14.

13,124. O. Venter. Apparatus for treating yarns or threads with liquids. June 21.

16,823. C. D. Abel.—From the firm of Joh., Kleinewefers Söhne, Germany. Apparatus for mercerising cotton in the form of hanks. June 21.

23,428. E. Hantsch. Treating cotton yarn and apparatus therefor. June 21.

1899.

4899. R. Ziersch. Process for imparting a silk-like appearance to woven textile fabrics. June 7.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Applications.

10,293. H. von Niederhaüsern. A process for fixing alumina or chromic oxide or textile fibres as mordants, particularly for dyeing in Adrianople or Turkish red. Complete Specification. May 16.

10,448. Inglis and Wakefield, Ltd., and W. W. Wilson. Improvements in producing white patterns on cotton fabrics dyed with colours developed in the fibre. May 18.

10,554. F. M. Spence, D. D. Spence, and A. Shearer. Improvements in the preparation of mordants. May 19.

10,702. L. Wilson and J. Brandwood. Improvements in and connected with the dyeing of cotton yarn and thread wound in compact forms. May 23.

11,278. J. H. Bolton. Improvements in apparatus for dyeing, drying, or otherwise treating yarn in the hank. May 30.

11,402. A. Urban. Improvements in apparatus for dyeing, bleaching, and similarly treating textile fabrics, feathers, and the like. Complete Specification. June 1.

11,562. R. Brandts. A new or improved process for dyeing yarn roving with indigo blue.Complete Specification. June 2.

11,683. P. F. Denaeyer. Improvements in bleaching woollen and other textile materials. June 5.

11,803. H. Honegger. Improved process and apparatus for bleaching and dyeing. Complete Specification. June 6.

Complete Specifications Accepted.

1898.

11,951. H. Gotliffe. Means for printing waterproof fabrics. June 7.

14,429. T. Bentley. Hank scouring and dyeing apparatus. June 14.

14,758. C. H. Taylor.—Partly communicated by J. Santoux, France. Process and means for producing striped effects on textile and other fabrics. May 31.

14,917. J. Nelson. Machinery or apparatus for dyeing, bleaching, and mercerising cloth. May 31.

14,960. L. J. P. Dumons. Dyeing textile materials and apparatus for that purpose. May 31.

16,390. B. J. B. Mills.—From Mercier and Chaumartin, France. Process for dyeing fabrics, yarns and threads. June 7.

16,579. R. W. Kemp. A combined dyeing machine for dyeing cloth yarns (cotton, worsted, woollen, silk, and of all kinds of yarn and slubbing). June 21.

1899.

3431. H. Wächter. Process for the production of a substance for bleaching linen, cotton and other articles. June 14.

6063. S. H. Sharp and S. H. Sharp and Sons. Printing textile and other fabrics. May 31.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

10,245. C. F. Claus. Improvements in the production of compounds of alumina with fluorine and with alkaline fluorides, and in the production of alkaline fluorides to be used therein. May 15.

10,695. E. Lambert. Improvements relating to the drying or desiccation of superphosphates of lime and other substances, and to apparatus therefor. May 20.

10,757. A. J. Boult.—From The Pratt Process Company, United States. Improvements in the manufacture of sulphuric acid. Complete Specification. May 23.

11,054. F. H. Bowman and A. R. Dawson. Improvements in the manufacture of calcium and other carbides. May 26.

11,434. The United Alkali Company, Ltd., and M. Muspratt. Improvements in the manufacture of acetic acid. June 1.

11,521. A. E. Parker. Improvements in and relating to the manufacture of polysulphides of the alkali metals. June 2.

11,534. A. J. Boult. — From R. Wagnitz, Germany. New or improved process for production of superoxide of magnesium. June 2.

11,964. D. Matthews and The British Aluminium Company, Ltd. Improvements relating to the manufacture of titanic acid. June 8.

12,157. A. Béhal. Manufacture of mixed anhydrides of formic and organic acids, and the preparation from these of formylic derivatives of alcohol or ammonia, or of substitution products of ammonia. June 10.

12,226. R. Haddan.—From E. Gorgo, Italy. Improvements in processes and apparatus for evaporating brine. Complete Specification. June 12.

12,308. J. Ranald. *See* Class X.

Complete Specifications Accepted.

1898.

11,650. G. W. Johnson. — From Chemische Fabrik Griesheim, Germany. Purification of caustic alkalis. May 31.

13,496. A. F. Watson. Apparatus whereby solid carbonic anhydride can be converted into the liquid form and thus stored. June 14.

15,502. J. Hargreaves. Manufacture of alkalies, and in means applicable for use therein. May 31.

16,639. B. H. Thwaite and F. L. Gardner. Method of utilising the carbon monoxide evolved in the production of calcic carbide, and apparatus for that purpose. June 14.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

10,299. G. B. M. Gray and W. H. Wrazer. Improvements in or relating to moulds for making glass or similar ware. May 16.

10,311. A. Travaglini and J. B. Hall. Improvements relating to dies for use in the manufacture of mosaics. Complete Specification. May 16.

10,383. L. Lumsden. Improvements in or relating to the construction of kilns or muffle furnaces for firing pottery ware. May 17.

10,574. A. W. Anderson. *See* Class IX.

10,634. T. Holden and C. Brooke. Improvements in the manufacture of ornamental pottery or earthenware. May 20.

10,962. P. T. Sievert. Improvements in the manufacture of glass articles.

10,963. P. T. Sievert. Improvements in apparatus for the production of glass articles. May 25.

11,001. L. L. Grimwade. An improved method of decorating china and earthenware. May 26.

11,058. E. K. B. Rohardt and F. A. Teifke. A kiln furnace or oven for ceramics. Complete Specification. May 26.

11,071. L. L. Grimwade. An improved kiln for firing pottery ware. May 27.

11,650. J. Nitelet and J. E. Gillon. A new or improved composition for elastic enamel applicable to bricks and earthenware of all kinds. June 5.

11,744. A. J. Boult.—From G. B. M. Gray and W. H. Wrazer, United States. Improvements in or relating to moulds for making glass or similar ware. June 6.

11,891. R. Schlegelmilch. A new or improved frame of porcelain or other ceramic material. Complete Specification. June 7.

12,230. E. Nerme. Improvements relating to the decoration of earthenware. June 12.

Complete Specifications Accepted.

1898.

16,295. W. P. Rix. Moulding pottery, and apparatus therefor. May 31.

16,417. H. Burridge. Kilns or ovens for firing bricks and other ceramic goods. June 14.

16,665. V. F. L. Smith and E. Rüsäger. Kilns for burning cement and other substances. June 14.

20,616. W. P. Sauerland. Circular regenerative furnace for glass founding. June 14.

1899.

5180. W. F. Altenbaugh. Machines for automatically adling glass in manufacturing glassware. June 7.

6695. J. W. Colburn. Means or apparatus for forming and manufacturing articles of glass. May 31.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

10,574. A. W. Anderson. Improvements in kilns for burning bricks, pottery-ware goods, and cement. May 19.

10,618. S. Willner. Improvements in the process for the treatment of wood for the purpose of hardening and rendering the same fire- and water-proof. May 19.

10,904. W. Schulthess. Process for the production of compressed artificial sand-stones and apparatus therefor. May 24.

11,078. W. J. Chrystal. Improvements in the manufacture of mortar. May 27.

11,270. A. Grayson and W. J. Spratley. A new or improved brick for building and other purposes. May 30.

11,333. H. V. Simpson. Improvements in and relating to the treatment of wood with solutions for rendering it non-flammable and for other purposes. May 31.

11,536. J. H. McLean. Improvements in the manufacture of artificial stone, and in apparatus to be used therefor. June 2.

11,687. W. L. Wise.—From G. F. Culmer and G. C. K. Culmer, United States. Improvements in asphaltic fluxes and in the manufacture thereof. Complete Specification. June 5.

11,805. T. Rouse. Improvements in the manufacture of concrete and artificial stone for building, paving, and other purposes. June 7.

11,844. W. G. Thomson and J. E. Prossor. An improved paving and flooring block. June 7.

12,008. F. Player and P. Holmes. Improvement in the rendering of wood fireproof. June 9.

12,135. L. Hart. Improved fireproofing solution. June 10.

12,160. A. C. F. Bréband. An improved absorbent artificial stone. June 10.

12,411. H. W. Evans. Improvements in fireproof floors. June 14.

12,663. F. C. W. Timm. An improved shaft, kiln, or furnace for burning lime, cement, and like substances. Complete Specification. June 17.

12,664. F. C. W. Timm. Improvements in rotary or revoluble furnaces or kilns for burning cement, lime, and like materials. Complete Specification. June 17.

Complete Specifications Accepted.

1898.

11,170. A. Taylor. Hydraulic presses, and manufacture thereby of artificial stone slabs or the like. May 25.

15,656. C. Tschurl and C. Petraschek. Process and apparatus for preserving wood. May 25.

16,184. C. Schneider and W. F. L. Smidth. Kilns for burning Portland cement and other substances. June 7.

19,684. W. H. James, C. Wallis, and W. MacKinnon. Non-conducting fireproof substance and composition, especially suitable for use in the construction of fireproof buildings or parts of same. June 7.

1899.

1234. A. L. C. Nodon and L. A. Bretonneau. *See* Class XI.

5477. P. O. von Krottnaurer. Kilns for burning cement. June 14.

5571. H. Christiansen and J. H. Krone. Method for the production of a very porous substance or material for and the manufacture of walls, conduit pipes, and the like. June 21.

6311. F. Gehre. Artificial stone. May 31.

7789. H. H. Lake.—From Sackett Wall Board Co., United States. Mixing of plaster, cement, and like material. May 25.

8387. W. Körting. Block or slab for ceilings May 31.

8645. F. Spaight and Sons, Ltd., and T. J. Ferguson. Seasoning timber, and means and appliances for effecting the same. June 21.

X.—METALLURGY, MINING, Etc.

Applications.

10,233. C. F. Claus. Improvements in the treatment of hydrate of alumina and alumina to be used in the manufacture of metallic aluminium. May 15.

10,275. F. Westwood. Improvements in polishing and plating metals. May 16.

10,597. J. Pfeifer, A. Weimann, and J. F. Bachmann. Process for soldering or brazing metals in particular iron and steel. May 19.

10,756. E. H. Sturge. Improvements in the methods of chlorination for the extraction of metals from their ores, concentrates tailings, slimes, and the like. May 23.

10,763. W. G. Clark. An improved method of uniting copper with another metal. May 23.

10,777. W. J. Patterson and A. M. Acklin. Improvements in and relating to apparatus for casting slag and metals. Complete Specification. May 23.

10,850. T. Ryan, jun., and N., Hughes. Improvements in or appertaining to the extraction of zinc from substances or compounds containing the same. May 24.

11,141. R. Morris and W. T. Gent. Improvements in the manufacture of iron and steel. May 29.

11,268. O. Imray.—From J. R. Billings, United States. A method of treating molten iron or steel with pulverulent material and apparatus for that purpose. May 30.

11,534. A. J. Boult.—From R. Wagnitz, Germany. *See* Class VII.

11,542. The Golden Link Consolidated Gold Mines, Ltd., and H. J. Phillips. New or improved process for extracting precious metals from their ores. June 2.

11,544. A. D. Elbers. *See* Class V.

11,712. R. Tellenka, J. Kolbinger, and S. Hagyiristic. Improvements in moulds for casting magnesium compositions and similar cements. Complete Specification. June 6.

11,736. The Golden Link Consolidated Gold Mines, Ltd., and H. J. Phillips. New or improved process for extracting precious metals from their ores. June 6.

11,860. L. Lagarrigue. A process of and apparatus for the treatment of auriferous and other minerals by amalgamation. June 7.

11,907. G. T. Holloway and H. W. Lake. Improvements in the preparation of tungstates and other tungsten compounds and of metallic tungsten and its alloys. June 8.

11,963. D. Matthews and the British Aluminium Company, Ltd. Improvements in the manufacture of artificial cryolite. June 8.

11,989. A. P. Rushforth. Improvements in or relating to cupolas and blast furnaces. June 8.

12,066. J. Y. Johnson.—From the firm of Schroeder and Stadelmann, Germany. Improvements in the manufacture or production of metallic oxides. June 9.

12,130. C. T. Hennig. Alloy and process for making same. June 10.

12,154. L. Ott. Improvements in process of manufacturing aluminium bronze powder. June 10.

12,204. J. L. Stevenson and J. Evans. Blast furnace slag ladles. Complete Specification. June 12.

12,242. L. Ott. Improvements in process of granulating metals or metallic alloys and of manufacturing bronze powder. June 12.

12,308. J. Ranald. Improvements in converting ferrous chloride into ferric chloride, more especially intended for use in connection with the separation of bismuth or antimony from their sulphide ores. June 13.

12,323. K. Heberlein. Improvements in the treatment of galena and other sulphide ores with a view to the extraction of the lead or other metal contained therein. June 13.

12,335. E. J. Francis. Improvements in and relating to process of manufacturing sheet iron. Complete Specification. June 13.

12,390. M. B. Ryan. Improvements in the art of plating and colouring aluminium. Complete Specification. June 14.

12,512. E. C. H. Pape and C. A. L. W. Witter. Improved process for roasting mixed sulphide ores. Complete Specification. June 15.

Complete Specifications Accepted.

1898.

11,895. J. Armstrong. Treatment of sulphide, complex or other ores or mattes, and the recovery of metals therefrom. May 25.

11,940. R. Threlfall. Method of treating flue dust obtained from sulphide ores. May 25.

15,191. A. S. Bower. Apparatus for use in protecting iron and steel by producing magnetic oxide thereupon. June 21.

15,645. F. Ellershausen. Treatment of refractory sulphide ores. June 21.

24,878. A. G. Brookes.—From L. Mach, Germany. New or improved alloy of aluminium and magnesium. June 14.

25,481. W. P. Thompson.—From P. Argall, United States. Apparatus for cooling ores. May 31.

1899.

5501. O. F. Liebert. Production of armour and like compound plates, and apparatus therefor. June 21.

7110. W. H. Wheatley.—From La Société Générale des Aciers, fins., France. Steel, and process of manufacturing the same. June 7.

7185. E. D. Wassell. Process of annealing steel. June 7.

7878. H. Rensing. Process for the manufacture of lime blocks and ore briquets. June 7.

7893. L. Pszczolka. Method and apparatus for reducing pig iron containing silicon or phosphorus into "Bessemer" or "Thomas" steel. June 14.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

10,205. R. Girouard. Liquid feed devices for electrolytic and kindred apparatus. Complete Specification. May 15.

10,215. M. Haas. Improvements in electrolytic apparatus. Complete Specification. May 15.

10,317. E. L. Dessolle. Improved electro-plating process, and apparatus therefor. Complete Specification. May 16.

10,320. H. Carmichael. Improvements in electrodes and electrode connections in liquid feed devices for electrolytic apparatus and in the construction of enclosing-vessels for electrolytic and kindred apparatus. Complete Specification. May 16.

10,744. E. L. Lobdell. Storage batteries. Complete Specification. May 23.

10,911. A. Pfannenberg. Improvements in primary batteries. Complete Specification. May 24.

11,166. P. Marino. An improvement in electrolytes for deposit of metals. May 29.

11,172. Veritys, Ltd., and L. J. Steele. An improved apparatus for controlling electric currents, especially applicable for charging secondary batteries or accumulators. May 29.

11,244. H. Blumenberg, jun. Improvements in compounds for battery solutions. May 30.

11,349. L. G. Leffer. Improvements in electrodes or plates for secondary batteries. Complete Specification. May 31.

11,422. J. G. A. Rhodin. An improvement in electrolytic apparatus. Complete Specification. June 1.

11,424. P. Marino. Improvements in accumulator batteries. June 1.

11,443. W. P. Thompson.—From E. Giglio, Egypt. Improvements in electric batteries. June 1.

11,657. H. Leitner. Apparatus for forming plates of secondary batteries. June 5.

11,678. W. P. Thompson.—From H. Becker, France. Improvements in electrolytic apparatuses for extracting metals lighter than the electrolyte. June 5.

11,717. A. E. Hodgson. Improvements in electric batteries. June 6.

11,780. W. A. Gent and S. Jevons. A new or improved mould for casting plates or grids for secondary batteries. June 6.

11,879. E. A. G. Street. Production of chromium oxide by electrolysis. June 7.

11,930. T. M. I. Wilhelm and H. Richard. An improved electrolytic apparatus. Complete Specification. June 8.

12,131. R. F. Drury. An exciting fluid for generating a constant current in primary batteries. June 10.

12,171. W. E. Case. Improvements in galvanic cells. Complete Specification. June 10.

12,172. W. E. Case. Improvements in galvanic cells. Complete Specification. June 10.

12,309. P. A. Newton.—From The Knickerbocker Trust Co., United States. Improvements in storage batteries and methods of preparing electrodes therefor. Complete Specification. June 13.

12,478. O. Behrend. Improvements in electrical accumulators or secondary batteries. June 15.

12,627. E. Andreas. Improved manufacture of electric battery plates. June 16.

Complete Specifications Accepted.

1898.

11,570. G. Bell and G. W. Bell. Electrolytic cells. May 25.

12,765. W. P. Thompson.—From M. Hazard-Flamand, France. Electrolysis of liquids and apparatus therefor. May 25.

14,132. W. L. Durban and J. Gore. Electrical furnaces, more particularly applicable for the production of calcium carbide. May 25.

14,316. A. E. J. Ball. Dry and other galvanic batteries. June 21.

15,967. J. W. Kynaston. Cells applicable for the production of chlorine and alkali metal amalgams by electrolytic decomposition of solutions of alkaline chloride. June 14.

17,268. O. Behrend. Secondary batteries or electrical accumulators. June 14.

1899.

1234. A. L. C. Nodon and L. A. Bretonneau. Electrocapillary treatment of woody and other fibre, and apparatus therefor. June 14.

10,119. G. Heidel. Electrodes for batteries. June 21.

XII.—FATS, OILS, AND SOAP.

Applications.

10,391. T. Macalpine. Process and means for refining mineral and petroleum oils. May 17.

11,602. C. Frowein. Improvements in oil purifying apparatus. Complete Specification. June 5.

11,772. W. Erben. *See* Class V.

12,236. W. P. Thompson.—From M. Novaretti, Italy. Improvements in apparatus for purifying engine lubricating oil and the like. Complete Specification. June 12.

12,349. F. Boleg. *See* Class XIII.

Complete Specifications Accepted.

1898.

17,842. J. McNeil. Manufacture of soap. June 14.

1899.

9689. W. L. S. Van Loo. Manufacture of siccative oil, mostly from petroleum. June 21.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

Applications.

10,319. J. F. Duke. *See* Class IV.

10,342. G. Wegelin. A process for the manufacture of soot, lamp-black, and the like of high specific gravity. Complete Specification. May 16.

10,820. A. E. J. V. J. Theilgaard. Improvements in the process of disvulcanising caoutchouc india-rubber, gum elastic and similar materials. Complete Specification. May 23.

10,821. A. E. J. V. J. Theilgaard. Improvements in the process of disvulcanising caoutchouc, india-rubber, gum elastic and similar materials. Complete Specification. May 23.

10,822. A. E. J. V. J. Theilgaard. Improvements in the process of disvulcanising caoutchouc, india-rubber, gum, elastic, and similar materials. Complete Specification. May 23.

11,159. A. J. Boult.—From A. H. Marks, United States. Improvements in or relating to a process for reclaiming rubber waste. Complete Specification. May 29.

11,588. A. Cairns. An improved substitute for rubber or gutta-percha. June 5.

11,957. A. Turski. A process for the manufacture of oil colours. Complete Specification. June 8.

12,176. W. Ellram. Improvements in the production of sealing and bottle-closing wax. June 10.

12,211. A. Frank. Improvements relating to the production of carbon, and to the utilisation of such carbon in the manufacture of pigments, inks, and the like, and in the cementation of metals. June 12.

12,349. F. Boleg. Improvements in treating mineral, resin, tar oils, and in the preparation of products therefrom. June 13.

12,487. J. Warnatzsch. An improved composition for polishing and otherwise treating leather and the like, and a process for its manufacture. June 15.

12,538. J. G. Deiss. Improved process for extracting india-rubber or gutta-percha from vegetable which contain them. Complete Specification. Filed June 15. Date applied for Feb. 14, 1899, being date of application in France.

Complete Specifications Accepted.

1898.

12,211. J. R. Wood. Varnish. May 31.

1899.

8041. A. E. J. V. J. Theilgaard. Process of disvulcanizing caoutchouc, india-rubber, gum elastic, and similar materials. May 25.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

Applications.

10,385. A. E. Vidal. Improvements in and relating to the tanning of hides and skins. May 17.

10,408. R. Brauer. Improved process of extracting tannin from leather and preparing the latter for glue making. Complete Specification. May 17.

10,985. J. Y. Johnson. From W. F. Sykes, United States. Improvements in dyeing and tanning skins. May 25.

11,314. A. E. Vidal. Improvements in and relating to the tanning of hides and skins. May 31.

12,261. W. S. Smith. An improved process of oil leather dressing. June 13.

Complete Specifications Accepted.

1898.

12,553. W. W. McLaurin. New or improved substitute for leather, and process for preparing same. June 7.

14,724. G. Feith. Process of rapid tanning. May 25.

16,545. W. Turner. Machinery for dressing or working hides, skins, and the like. June 21.

1899.

7066. D. Young.—From The Vaughan Machine Company, United States. June 7.

8590. F. Schedlinsky. Tanning process. June 21.

XV.—AGRICULTURE AND MANURES.

Applications.

10,204. A. G. Brookes. From F. Lorenz, successor to J. Lutjens, Germany. *See* Class I.

11,842. J. Golding. A new fertilising substance for promoting the better growth of plants. June 7.

12,233. A. Wenck. Improvements in the manufacture of artificial manure. Complete Specification. June 12.

Complete Specifications Accepted.

1899.

7974. D. Crawford. Apparatus for the manufacture of superphosphates and other chemical manures. June 21.

9260. A. G. Brooks.—From Chemische Fabrik Actien Gesellschaft vorm. C. Scharff and Co. Process and apparatus for comminuting or disintegrating superphosphates. June 14.

XVI.—SUGARS, STARCHES, GUMS, Etc.

Applications.

11,416. M. D. Petersen, *née* Christiansen. Improvements in the manufacture of laundry starch. Complete Specification. June 1.

12,466. H. F. Whitehead. An improved adhesive composition. June 15.

12,598. B. Temme. An improvement in the manufacture or refining of sugar. June 16.

Complete Specifications Accepted.

1898.

11,511. E. Beanes. Manufacture of sugar. May 25.

12,020. F. Virneisel. Process for producing soluble starch. May 25.

1899.

8222. M. B. Zahn. Treatment of sugar, molasses, or syrup, by means of lime. June 21.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

10,195. A. Müller. Improvements in apparatus for use in boiling and treating hops. Complete Secification. May 15.

10.211. F. Sauer. Process for maturing alcoholic liquors. May 15.

11,107. J. T. Knowles.—From T. A. Bryan and C. H. Boone, United States. An improved method or process of improving alcoholic liquor. May 27.

11,726. J. J. Knight and J. Sampson. Improvements in apparatus for the treatment of the waste liquor from spirit distilleries. June 6.

11,732. H. Fowell. Waste beer utiliser. June 6.

11,876. E. P. y Mendivil. New process for producing wine by previously sterilising the must of grapes. Complete Specification. June 7.

12,146. W. P. Thompson.—From M. Klar and C. Schulze, Germany. Improved method of producing mixtures of air and alcohol, with the object of directly converting ethyl alcohol and its homologues or compounds of such into the corresponding aldehydes and apparatus therefor. June 10.

12,583. J. Schmitz and G. Kreutzer. Wet bruising mill for beer brewing and process for preparing mash by the use of this mill. June 16.

Complete Specifications Accepted.

1898.

14,305. F. Faulkner and J. E. J. Johnson. Brewing and the production of alcoholic beverages. May 25.

15,771. D. Striebeck. Cooling beer. June 14.

16,896. A. Munsche. Fermentation and manufacture of perfumed malt-wines. June 7.

17,357. J. Declercq. Malting apparatus. June 21.

1899.

1843. H. Hempel. Process for producing spirits in solid form. June 14.

9331. B. Fischer. Apparatus for malt floors or for malt kilns. June 21.

9804. E. E. Murphy. Method of and apparatus for carbonating water or other liquids. June 14.

XVIII.—FOODS, SANITATION, Etc., and DISINFECTANTS.

Applications.

A.—Foods.

10,185. E. Langheld. A new or improved method of treating substances used as food or medicines for the purpose of removing the toxic properties therefrom. Complete Specification. May 15.

10,480. J. R. Hatmaker.—From J. A. Just, United States Casein food compound. May 18.

11,203. R. Graham. A process for the conversion of oats, wheat, barley, and such like into food stuffs. May 30.

11,659. C. J. Dick. Fruit and vegetable vapour preservation process. Complete Specification. June 5.

11,664. H. J. Bucka, C. Hansen, and O. B. Wimmer. An improved process for preserving milk. June 5.

12,325. O. Avedyk. Improved process for converting cereals into alimentary preparations. June 13.

B.—Sanitation.

10,353. A. J. Liversedge and Beaman and Deas. Improvements in refuse-destructor furnaces. May 16.

10,386. W. M. Ducat. An improvement in aerobic bacterial filters for the purification of sewage and other foul waters. May 17.

10,412. M. May, jun. Improvements in mechanical purification of effluents of towns, factories, and the like, and in apparatus therefor. May 17.

10,494. T. H. Ramsden. Improvements in or connected with the bacterial treatment of sewage, and in apparatus therefor. May 18.

10,586. H. Reisert. A new process of and means for automatically cleansing filter material. May 19.

10,619. C. A. Sahlström. Improvements in the process for deodorising, bleaching, and purifying. May 19.

11,994. W. C. C. Pakes. Improvements in apparatus for bacteriological treatment of sewage. June 9.

11,995. W. Pare. Improvements in apparatus for the treatment of sewage or other liquids. June 9.

12,381. W. B. Bennett. Improvements in the treatment and purification of sewage and other polluted waters. June 14.

Complete Specifications Accepted.

A.—Foods.

1898.

15,654. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering, Germany. Preservation of meat, and in apparatus therefor. May 25.

1899.

8993. R. Multedo. Manufacture of alimentary or nutritive pastes or doughs, and apparatus therefor. June 14.

9431. A. Brecher and A. Kittel. Process for the preservation of milk. June 14.

9586. J. W. C. Hamilton and J. A. Linley. Manufacture of food from blood. June 14.

B.—Sanitation.

1898.

14,997. G. D. Wild. Treatment for the purification of sewage of all kinds, domestic or otherwise, including effluents from dyeworks. June 14.

C.—Disinfectants.

1898.

15,819. A. E. Berry and A. B. Roberts and Co., Ltd. Manufacture of a new chemical salt of valuable antiseptic properties. May 31.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

10,249. A. Faust. Pulp, other material colour and water saving, and water clearing apparatus for paper and paper pulp manufacture, &c. May 16.

10,798. J. A. Wheeler and S. W. Ellis. Process of moulding fibrous pulp. Complete Specification. May 23.

11,275. C. Wurster. Improvements in machines for pulping up paper and paper materials. Complete Specification. May 30.

11,592. Mrs. L. Hay. Aseptic paper and inks. June 5.

Complete Specification Accepted.

1898.

11,974. R. Cremer.—From L. J. Derenfeld, Germany. *See* Class II.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Applications.

10,853. J. Klimont. Improvements in the production of violet perfume. May 24.

10,992. A. Searl. Improvements in processes for the manufacture of extracts or essences of tea and of coffee. May 26.

11,222. J. Bechtold. Process for making wine-chocolate extract. Complete Specification. May 30.

11,420. C. D. Abel.—From B. Jaffé and Darmstaedter Lanonlinfabrik, Germany. Manufacture of piperazine quinate, and quinates of piperazine derivatives and their alkali salts. Complete Specification. June 1.

11,866. G. B. Ellis.—From La Société Chimique des Usines du Rhône anciennement G. P. Monnet et Cartier, France. New compounds of bismuth and their preparations. June 7.

12,348. F. Boleg. Improved process for the preparation of permanent emulsions soluble in water of aromatic hydrocarbons and etherial oils and pharmaceutical products. June 13.

12,492. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of derivatives of cinnamic acid. June 15.

Complete Specifications Accepted.

1898.

13,714. L. Sell. Manufacture of a new preparation from saligenin. June 21.

1899.

6141. W. Krauth. Manufacture of di-hydro-ionone and its homologues. June 7.

6797. O. Imray.—From the firm of F. Hoffmann La Roche and Co., Switzerland. Manufacture of a compound of mercuric phenol-para-sulphonate with ammonium tartrate. May 31.

7244. F. Valentiner. Production of fluoroform. June 21.

XXI.—PHOTOGRAPHY.

Applications.

11,025. C. D. Abel.—From Actiengesellschaft für Anilin Fabrikation, Germany. Improved process for intensifying photographic silver prints. May 26.

11,255. J. T. Bentley. Improvements relating to photo-reproduction processes and to apparatus therefor. May 30.

11,533. J. F. Guimaraes. Intense lighting apparatus for instantaneous photography called a Relampago Guimaraes. Complete Specification. June 2.

11,997. R. W. Paul. Improvements in animated photography. June 9.

12,152. G. Macaire. Improvements in photographic films. June 10.

12,371. S. Quincey. Improvements in and relating to means for the development and sensitizing of photographic plates, papers, or the like without the necessity of the dark room. June 14.

12,515. G. Selle. *See* Class I.

12,516. G. Selle. Improvements relating to the sensitising and relative sensitive adjustment of photographic plates or the like for use in colour photography, and to the measurement of time exposure of said plates. June 15.

12,517. G. Selle. Improvoments in the formation of films for use in colour photography. June 15.

12,585. The Rotary Photographic Company, Ltd.—From A. Schwarz, Germany. Improvements in photographic paper adapted for printing out and other purposes. June 16.

Complete Specifications Accepted.

1898.

12,272. E. Neuhaus. Process for the production of relief photographs without the use of mould or block. June 7.

13,315. C. M. Epworth and C. Urban. Printing and development of photographic film. May 25.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

10,865. L. Purgotti and A. Purgotti. Employ of the cupreous rhodanate in the manufacturing of matches of whatever kind. Complete Specification. May 24.

10,868. A. Lagerqûist. Baryt-matches. May 24.

11,051. H. P. Hurst. Improvements in safety fuses or detonators for explosive projectiles and their fittings. Complete Specification. May 26.

11,185. L. M. Rahmiel. Improved lucifer match. May 29.

11,319. H. A. Anderson. An "explosive paste" for use as a detonating compound or explosive. May 31.

11,929. J. Selwig. Improved apparatus for transporting guncotton or similar nitrated substances freed from the surplus of acid in nitrating or acid-centrifugals. June 8.

12,147. H. P. Hurst. Improvements in and relating to explosive shells and fuses, and fillings for exploding or detonating the explosive. Complete Specification. June 10.

12,316. A. J. Boult.—From J. F. T. Sargent, United States. An improved process for producing nitro-explosives. June 13.

12,392. F. J. W. Lindeman. Improved manufacture of explosives. Complete Specification. June 14.

12,428. J. Y. Johnson.—From The Chemische Fabrik vormals Goldenburg, Geromont and Co., Germany. Improvements in or connected with the manufacture of explosives. June 14.

12,591. C. H. Curtis and A. H. Durnford. Improvements in the manufacture of explosives. June 16.

Complete Specifications Accepted.

1898.

13,466. R. S. Maguire and D. P. Maguire. Lucifer matches. May 25.

16,314. H. Sévène and E. D. Cahen. Manufacture of inflammable pastes suitable for matches. May 31.

16,403. W. L. Wise.—From The Maschinenfabriken Oerlikon, Switzerland. Time fuses. June 7.

16,481. W. Hope. Gunpowders and other explosives. May 25.

1899.

1700. H. P. Hurst. Explosive shells, and fuses and fuse fittings. May 31.

2149. J. O. Gunn. Explosive compounds. June 7.

7144. E. F. Trachsel. Manufacture of a base for igniting compound more particularly for use in the manufacture of matches. May 25.

7352. W. Ross. Explosives. June 14.

PATENTS UNCLASSIFIABLE.

Applications.

12,069. M. Otto. An improved product obtained by the solution of ozone in petroleum. June 9.

12,532. B. Freitag. Improved means for treating animal blood for separating and obtaining clear albumen and other products therefrom. June 15.

Complete Specification Accepted.

1898.

17,466. W. S. Hill and W. P. Ingham. Manufacture of slag wool or silicate cotton. June 21.

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Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.

THE JOURNAL

OF THE

Society of Chemical Industry.

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 7.—Vol. XVIII.]

JULY 31, 1899.

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A. Liebmann.
A. K. Miller.
F. Scudder.
Edw. Schunck.
C. Truby.

Hon. Local Secretary:
J. Carter Bell, The Cliff, Higher Broughton, Manchester.

Newcastle Section.

Chairman: N. H. Martin.
Vice-Chairman: F. S. Newall.
Committee:

A. Allhusen.
P. P. Bedson.
G. T. France.
T. W. Hogg.
H. Louis.
H. S. Pattinson.
John Pattinson.
W. W. Proctor.
W. L. Rennoldson.
G. Sisson.
J. E. Stead.
J. K. Stock.

Hon. Local Secretary and Treasurer:
Saville Shaw, Durham College of Science, Newcastle-on-Tyne.

New York Section.

Chairman: T. J. Parker.
Vice-Chairman: Clifford Richardson.
Committee:

H. Binney.
C. F. Chandler.
H. Clementson.
V. Coblentz.
B. B. Goldsmith.
T. Hartford.
J. Hasslacher.
A. G. Love.
R. W. Moore.
C. E. Pellew.
G. A. Prochazka.
Max Toch.
S. A. Tucker.

Hon. Treasurer: R. C. Woodcock.
Hon. Local Secretary:
H. Schweitzer, 40, Stone Street, New York, U.S.A.

Nottingham Section.

Chairman: F. Stanley Kipping.
Vice-Chairman: J. O'Sullivan.
Committee:

L. Archbutt.
S. F. Burford.
F. J. R. Carulla.
R. M. Caven.
H. Forth.
W. Scott Herriot.
J. F. Kempson.
J. M. C. Paton.
A. L. Stern.
J. J. Sudborough.
S. Trotman.
G. J. Ward.

Hon. Treasurer: S. J. Pentecost.
Hon. Local Secretary:
J. T. Wood, 29, Musters Road, West Bridgeford, Nottingham.

Scottish Section.

Chairman: G. G. Henderson.
Vice-Chairman: A. P. Aitken.
Committee:

W. Carrick Anderson.
E. M. Bailey.
G. T. Beilby.
A. C. J. Charlier.
J. Christie.
John Clark.
C. A. Fawsitt.
W. Foulis.
W. Frew.
R. A. Inglis.
Robt. Irvine.
A. D. Ker.
J. B. Readman.
E. C. C. Stanford.
R. T. Thomson.
T. N. Whitelaw.

Hon. Secretary and Treasurer:
Thomas Gray, Technical College, 204, George Street, Glasgow.

Yorkshire Section.

Chairman: Christopher Rawson.
Vice-Chairman: George Ward.
Committee:

J. E. Bedford.
F. W. Branson.
H. K. Burnett.
A. W. Cooke.
T. Fairley.
W. M. Gardner.
Edw. Halliwell.
J. J. Hummel.
W. McD. Mackey.
H. R. Procter.
G. W. Slatter.
Thorp Whitaker.

Hon. Local Secretary and Treasurer:
H. R. Procter, The Yorkshire College, Leeds.

NOTICES.

Collective Index.

The Collective Index (1881—1895) is now ready. The prices are as follows:—

To Members and Past Members; Libraries, Societies, and Exchanges on the Society's List	Each copy	10*s.*
To Subscribers	„	12*s.* 6*d.*
To others	„	15*s.*

Hurter Memorial Fund.

The Liverpool Committee hopes to close the subscription list to the above fund by September 1st, and would ask members to send their contributions as soon as possible to Mr. Eustace Carey, 30, James Street, Liverpool.

Newcastle Photograph.

Applications for the photograph taken at the Durham College of Science should be addressed to James Bacon, Northumberland Street, Newcastle-on-Tyne. Price 4*s.* 6*d.*

The Society's Office will be closed from September 4th to September 16th next.

Notice is hereby given, for the information of members and advertisers, that the advertisement columns of this Journal have been contracted for by Messrs. Eyre and Spottiswoode, the Society's printers and publishers, to whom all communications respecting them should be addressed. The circulation of the Journal is now more than 3,500 per month.

LIST OF MEMBERS ELECTED 12th JULY 1899.

Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.

Carney, Jas. A., Beardstown, Ills., U.S.A., Division Master Mechanic, C. B. & Q. Railway.

Clayton, Harold, 17, Woodville Road, Chorley, Lancashire, Colourist and Chemist.

Hinchley, J. W., 15, Fawcett Street, London, S.W., Chemical Engineer.

Lachman, Albert, California Wine Association, San Francisco, Cal., U.S.A., Wine Merchant.

Loder, Francis H., Fairfield, Mycenae Road, Blackheath, S.E., Director.

Logan, Jno., Moatfield House, Timperley, Cheshire, Indigo-Blue Dyer.

Neate, Percy J., 268, High Street, Rochester, Kent, Director of Cement Co.

Neurath, Dr. F., 37, George Street, Cheetham Hill, near Manchester, Chemist.

Rushby, Wm., Cheapside, Batley, Yorks, Analyst.

LIST OF MEMBERS ELECTED 25th JULY 1899.

Fuller, Robt. F., Neston Park, Corsham, Wilts, Rubber Manufacturer.

Jackson, W. Morton, c/o Manchester Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.

Jennings, Thos., Brookfield, Cork, Ireland, Chemical Manufacturer.

Lynn, Vaughan G., c/o Messrs. Best and Co., Madras, India, Merchant.

Sutherst, Dr. Walter F., 10, Giles Street, Horton Lane, Bradford, Yorks, Science Master.

Yates, Arthur, P.O. Box 182, Johannesburg, S.A.R., Metallurgist.

CHANGES OF ADDRESS.

Abbott, Jno.; Journals to 70, Gracechurch Street, E.C.

Adcock, S. R., l/o Rio Tinto; retain Journals until further notice.

Aykroyd, H. E., l/o Bradford; Glen Rosa, The Grove, Ilkley, Yorks.

Boot, J. C., l/o Jersey City; Klatten, Java, Netherlands Indies.

Brown, Edw., l/o St. Petersburg; Tannin Extract Works, Zelenie Dol Station, Moscow-Kazan Railway, Russia.

Burford, S. F., l/o Leicester; The Firs, Kirby Muxloe, near Leicester.

Calder, W. A. S., l/o London; Brunswick Terrace, Wednesbury.

De Lessing, G. C., l/o Woburn Place; 49, Bernard Street, Russell Square, W.C.

Dowling, W. R., l/o Box 158; c/o W. W. Rand G. M. Co., Box 1019, Johannesburg, S.A.R.

Durant, H. T., l/o Johannesburg; 111, Chetwynd Road, Dartmouth Park Hill, N.W.

English, Frank H., l/o Padiham; Manchester Road, Hapton, Lancashire.

Heaton, Jno., l/o Brookside Gardens; 3, Belle Vue Park, Sunderland.

Hellier, E. A., l/o Westbourne Avenue; 90, Marlborough Avenue, Hull.

"Jahresbericht der Chemie," l/o Berlin; F. Vieweg und Sohn, Brunswick, Germany.

Johnson, E. H., l/o Box 27; Box 1127, Johannesburg, S.A.R.

Johnston, A. R., l/o North Woodside Road; 12, Percy Street, Ibrox, Glasgow.

Liversedge, A. J., l/o 32; 109, Victoria Street, Westminster, S.W.

Lungwitz, Dr. E. E., l/o Berlin; 14, Belvedere Street, Brooklyn, N.Y., U.S.A.

Macindoe, G. D., l/o Auckland; Belfast, Christchurch, New Zealand.

Mackenzie, T. E., l/o Mount Florida; 6, Cardonald Park Terrace, Cardonald, Renfrewshire, N.B.

Neilson, Thos., l/o California; c/o Nielsen M. & S. Co., Red Rock, Arizona, U.S.A.

Power, Dr. F. B.; Journals to 6, King Street, Snow Hill, E.C.

Robinson, Prof. H. H., l/o Hankow; Nankin, China.

"Royal Photographic Society," l/o Hanover Square; 66, Russell Square, W.C.

Sinclair, Dr. Wm., l/o Cluny Drive; 60, Stirling Road, Trinity, Edinburgh.

Skvortzoff, B. N., l/o Elabouga; Works of Oushkoff and Co., Kasan, Russia.

Smith, Jas. F.; 22, *not* 20, Medlicott Road, Sparkbrook, Birmingham.

Tonkin, Jno., l/o Bayonne; 2603, East Broad Street, Richmond, Va., U.S.A.

Warden, Lt.-Col. C. J. H.; Journals to 26, Highbury Grove, London, N.

Watt, Alex., l/o Sefton Park; c/o Macfie and Sons, 34, Moorfield, Liverpool.

Wyld, Jno., l/o Birmingham; North Avenue, Lidgett Park, Roundhay, Leeds.

CHANGES OF ADDRESS REQUIRED.

Buchan, Alex., l/o Palace Terrace, Wood Green, N.

Edwards, W. B., l/o Willesden Paper Works, Willesden Junction, N.W.

Mistovski, L., l/o Broadfield Rubber Works, Heywood.

Prinz, Dr. Otto, l/o Sesto Fiorentino, Italy.

Rosenblum, S., l/o Imperial Chambers, Cursitor Street, W.C.

Deaths.

Hargreaves, Mark, 108, Fylde Road, Preston. June 27.

Simon, Henry, 20, Mount Street, Manchester. July 22.

Wilkie, T. M., of Ardeer, Stevenston, N.B. June 29.

Wood, W. Copland, Rosshead, Alexandria, N.B.

PROCEEDINGS
OF THE
EIGHTEENTH ANNUAL MEETING.

PRESIDENT: GEORGE BEILBY.

FIRST DAY.—WEDNESDAY, JULY 12TH.

The eighteenth annual general meeting of the Society of Chemical Industry was held at Newcastle-upon-Tyne, in the Chemical Theatre of the Durham University College of Science, on Wednesday, July 12, Mr. George Beilby, President of the Society, in the chair.

The SECRETARY read the minutes of the last annual general meeting, held on Wednesday, July 13, 1898, at University College, Nottingham.

WELCOME BY THE MAYOR.

The MAYOR OF NEWCASTLE (Councillor George Harkus) attended to welcome the Society on behalf of the citizens. His Worship said: Mr. President and Gentlemen, as mayor of this city, I have great pleasure in offering the members of the Society of Chemical Industry a most hearty welcome, and I hope that, at the conclusion of your holiday, you will leave Tyneside thoroughly convinced that, whatever may be our faults, north-country people have warm hearts. The programme arranged for you will enable you to judge of the great works carried on in this district—works which do not tend to improve the appearance of the landscape; but you will also have abundant opportunity of ascertaining for yourselves that Newcastle is not the smoky city so often spoken of by strangers. Newcastle has many beautiful spots within its borders, and the mayoress and myself will have much pleasure in welcoming you to one of these beautiful spots on the Leazes this afternoon.

The PRESIDENT, in responding, said: Mr. Mayor,—We appreciate your great kindness and the honour you have done us in coming personally to welcome us to Newcastle, and we much appreciate the graceful way in which you have conveyed your good wishes for our enjoyment and for the success of our meeting. We, as a society, pride ourselves that we are the connecting link between the great industries, the great commercial interests of this country, and chemistry and the sciences related to chemistry. It is gratifying to know that, in Newcastle, you appreciate that there is that association, and that there ought to be that association, between pure knowledge and science and the great industries and commerce; because you have in your midst a successful university college, which concerns itself especially with engineering and chemistry. It is also gratifying to us to know that you will do everything in your power to encourage the Society, and also to encourage our representative here, which is always with you—the Newcastle Section. Newcastle has had a great past in the history of chemical industry. I believe it has also a great future; and that future will be assured—and will only be assured—if there is that hearty co-operation between science and industry which has been attended with such marvellous success in Germany. Again, I thank you, Mr. Mayor, for your welcome.

ELECTION OF OFFICERS

The SECRETARY (Mr. C. G. Cresswell) announced the election of officers for the ensuing year, as follows:—

President:

Prof. C. F. Chandler, M.D., Ph.D. (New York).

Vice-Presidents:

George Beilby.
R. Forbes Carpenter.
Prof. F. Clowes, D.Sc.
George E. Davis.
John Heron.
David Howard.
Dr. C. A. Kohn.
Ivan Levinstein.
B. E. R. Newlands.
Dr. Edw. Schunck, F.R.S.
Wm. Thorp, B.Sc.
R. C. Woodcock.

Ordinary Members of Council:

Sir John Evans, K.C.B., F.R.S.
Sir David Gamble, Bart., C.B.
W. Winwood Gossage.
E. Grant Hooper.
Dr. Rudolph Messel.
J. M. C. Paton.
John Pattinson.
Dr. Fred. B. Power.
Sir Robert Pullar.
Walter F. Reid.
Dr. Wm. S. Squire.
E. C. C. Stanford.

Honorary Treasurer:
Samuel Hall.

Hon. Foreign Secretary:
Dr. Ludwig Mond, F.R.S.

THE PRESIDENT-ELECT.

The PRESIDENT: The President-elect has usually been present in person at the annual meeting, and has had the opportunity of saying a few words. Unfortunately, Prof. Chandler has not seen his way to come over to this meeting, but he has written me a letter which may take the place of his own personal acknowledgment. I am sure we all recognise the great importance to the future of the Society of this new departure which has been made in the appointment of a President on the other side of the Atlantic. Our New York Section is one of the most rapidly growing, and one of the most powerful sections in our body, and it is of great importance that the variety of interests on the other side of the Atlantic should be represented, and I feel that they are represented in the person of the President. I now call upon the Secretary to read Prof. Chandler's letter.

The GENERAL SECRETARY read Prof. Chandler's letter to Mr. Beilby, as follows:—

"New York, June 30, 1899.

"MY DEAR MR. BEILBY,

ALTHOUGH I promptly accepted by cable, as soon as I received your cablegram informing me of my nomination as President of the Society of Chemical Industry, I fear I have neglected my duty in not at the same time sending you my written acceptance. The nomination I am most happy to accept, as a compliment to the New York Section, and as an evidence of the thorough good feeling which happily exists between the two branches of the Anglo-Saxon race living on the opposite shores of the Atlantic. I also fully appreciate the honour conferred on me, personally, by my selection by the Council as an acceptable representative of the American chemists. You may be sure I shall do everything in my power, if I am elected, to justify the nomination. I shall also be most happy to acquiesce in any arrangement the Council may consider desirable, in view of my residence at so great a distance from London, and the impossibility of my attending the regular meetings of the Council. If the nomination of a representative should lie with me, I should suggest yourself, the retiring President, as the most suitable person to act in my place.

"Yours, &c.,
(Signed) "C. F. CHANDLER."

LETTERS OF APOLOGY.

The SECRETARY (Mr. Cresswell) said that letters of apology had been received from several members of the Council who had desired particularly to be with them that day, but were unable to come. He mentioned Mr. Otto Hehner, Vice-Chairman of the London Section, who was particularly anxious to be present to second one of the resolutions; Mr. R. Forbes Carpenter, who was ordered abroad for his health; Mr. Wm. Thorp, who was prevented at the last moment from attending, by a painful affection of the eye, contracted in the course of his arduous labours on the Collective Index; Mr. Gordon Salamon, who was detained on legal business; Mr. A. R. Ling, Secretary of the London Section; Sir Lowthian Bell; and Sir David Gamble, who had hoped to be with them that day, but had another engagement in London.

REPORT OF COUNCIL.

We have the honour to report that the number of members on the register is 3,312, as compared with 3,185 at the last Annual Meeting. During the year 299 new members have been elected, as compared with 311 last year. The loss has been 172, as compared with 152 last year. There have been 24 deaths: F. Andreasch; Edward Brooke; Joshua Buchanan; E. Rider Cook; Robert Cox, M.P.; George Foord; Mark Hargreaves; J. G. Heywood; Frank Livesey; Norman McCulloch; Adam Millar; Thos. Moore; Dr. E. F. Obach; P. K. Oushkoff; Thos. Owen, M.P.; Manning Prentice; Lt.-Col. H. E. Reynolds; John Riley, of Hapton; Sir Nathaniel Staples, Bart.; Prof. H. Trimble; W. A. Verel; Dr. Jno. F. Weightman; T. M. Wilkie; and J. R. Wylde.

The Council cannot allow this occasion to pass without referring to the great loss which the Society has sustained by the death of Mr. E. Rider Cook, who had been Hon. Treasurer since the commencement of the Society, President in 1890–91, and Representative of the Society on the Board of the Imperial Institute. He was unable to be present at our Meeting in Nottingham through illness, and died of cerebral hæmorrhage on Aug. 21st. With untiring industry and courtesy he laboured for the good of the Society, and his genial presence and wise counsel are sorely missed. The Society has appointed his brother-in-law and partner, Mr. Samuel Hall, as Hon. Treasurer in his place, thus preserving continuity in the traditions of the office.

During the past session 89 papers have appeared in the Journal, as compared with 87 last year. The excess of revenue over expenditure, as may be seen from the Treasurer's statement in the last number of the Journal, amounted last year to 552*l.* 15*s.* 7*d.*, as compared with 737*l.* 12*s.* 5*d.* the year before, though the gross revenue was nearly 240*l.* more. There was an increase of 350*l.* in Journal expenses, since there were 1,214 pages in the Journal, as compared with 1,064 in 1897—an increase of 15 per cent.; and the rest of the increased expenditure was divided between Sectional and Annual Meeting expenses. At the beginning of this year the membership of the various Sections was as follows:—London, 812; New York, 580; Manchester, 400; Scottish, 300; Liverpool, 260; Yorkshire, 200; Newcastle, 108; and Nottingham, 75.

In view of the desirability of the more frequent presence of sectional representatives at Council meetings, it was resolved, in September last, to include all fares incurred for this purpose among sectional expenses. The Council notes with satisfaction that most of the chairmen and secretaries have from time to time been present at the meetings during the past session.

During last autumn the Council and the two committees charged with the care of the Journal gave long consideration to the quality of the paper, type, and ink used for printing the Journal, in which they received valuable assistance from Mr. C. F. Cross, with the result that this year's Journal has been printed with new brevier type and better ink, on a paper free from loading, and approved by the highest authorities. The Council is indebted to Messrs. Somerville, Ltd., of Bristol, for their co-operation in the production of this paper.

In August last, Mr. Oscar Guttmann attended officially on behalf of the Society at the International Congress of Applied Chemistry at Vienna. The next Congress will be held in Paris, in August 1900, and the Council has appointed Mr. A. Gordon Salamon and Dr. R. Messel a committee to confer with the officials of the Congress with a view to secure a larger representation of British applied chemistry on that occasion.

At the close of last year the attention of the Council was drawn to the recently published Report of the Committee appointed by the Treasury to consider the desirability of establishing a National Physical Laboratory. The President was asked to represent to the Royal Society the desirability of allotting seats on the governing board of the Laboratory to this Council, in view of the interest felt by the chemical industries in physical and electrical research. These representations had weight, for when the Government agreed to make a grant in aid, and approved the draft scheme of the Laboratory, this Council was called upon to nominate two members of the Board, and chose Mr. George Beilby and Mr. Walter F. Reid. The President and Council of the Royal Society accepted these nominations, and further nominated Mr. Beilby as a member of the Executive Committee.

In February a request was made by the New York Section for greater facilities for nominating representatives on the Council and voting at annual meetings. Thanks to the alterations in the Byelaws made last year, the Council has been able to meet the views of the Section.

A new departure has been made this year in issuing the programme of the annual meeting in separate wrappers, in which upon occasion the ballot list would also be placed. On this occasion no ballot is required, as the number of candidates nominated does not exceed the number of vacancies to be filled.

In March the Council agreed to the proposal of the Liverpool Section to found a lecture in memory of the late Dr. Hurter, and authorised that Section to appeal to the members at large for subscriptions towards its endowment. The Council hopes that this will meet with a generous response. A sum of at least 300*l.* is required, and the treasurer of the fund is Mr. Eustace Carey, of Liverpool.

The relations of the Society to chemical engineering and industrial research have been fully treated in the lecture given by the President to the London Section on April 24 and in the discussion thereon. The Council hopes that means will be found to give effect to the views expressed by the President, and thanks those who have already offered to subscribe towards establishing courses of lectures on chemical engineering.

The Collective Index has just been delivered to those who have subscribed for it. Our thanks are due to the Index Committee, and particularly to Messrs. Walter F. Reid, Wm. Thorp, and the Editor, for their valuable aid in correcting page proof. Applications for copies of this work—which is not a digest of former indexes, but an entirely fresh compilation from the text by Mr. Renaut—should be addressed to the General Secretary.

If the income of the Society is to keep pace with the expenditure rendered necessary by the development of its work, there must be a continued increase in the number of members. The Council therefore hopes that each member will do all in his power to secure new candidates for membership.

The President, taking up a copy of the Collective Index, said he had the first copy of the great work in his hands. They must all join in congratulating the Committee on the completion of the work.

Mr. F. J. M. Carulla (Nottingham) moved the adoption of the report. He said:—The Society of Chemical Industry occupies a unique position in a great many respects; but the most unique is that of its international character. This has already been touched upon slightly in the report, and is one of which we ought not to lose sight. The New York Section will grow at an enormous pace; it is now the largest with the exception of London, and in a very short time you will find the New York Section will exceed the London Section. We shall have a Philadelphia Section, and a California Section, at San Francisco, and so on. It is, however, far easier to come from New York to attend a meeting of the London Section than to go from San Francisco to the New York Section. The work of the Council must inevitably become enormous; it is great at the present time. We ought therefore to be grateful, as a Society, for the work the Council has done, is doing, and will go on doing. I have therefore to propose that this report be heartily accepted.

Prof. P. P. Bedson: Mr. President and Gentlemen,—In rising to second the adoption of this report I have two remarks which I should like to make. The first is, I should like to offer my congratulations to the Council on the success of their action in obtaining a representative in connection with the very important work of the National Physical Laboratory. In the second place, I should also like to congratulate the Society on being the possessor of this beautiful and most wonderful index, the General Index, to which we have looked forward for some time. I have much pleasure in seconding the adoption of the report.

The motion was agreed to.

The Honorary Treasurer (Mr. Samuel Hall) presented the annual financial statement. He said:—

Mr. President and Gentlemen,—In presenting the Financial Report of the Society—your Council having done me the honour of electing me to carry on my late brother-in-law and partner's work as Treasurer—I can only assure the Society that I will endeavour that it shall be done with the same good will that he gave, and in which we have both been united since its commencement. Whilst I presume that we may in great part take the published balance sheets as read, a few words of explanation will not be out of place. We have some 3,300 members—162 increase on last year—and may be very proud of the position our Journal has taken in all parts of the world. It is distributed to 50 different nationalities, and it is interesting to note them. Austria, Bosnia, Greece, Holland, Italy, Norway, Portugal, Switzerland, and Sweden take from 1 to 5 copies each. Belgium, France, Germany, Ireland, Spain, and Russia take from 10 to 50 copies each. So far for Europe (excluding ourselves). Egypt, Asia Minor, Burmah, China, and Java take 1 to 3 each; India, 35; and Japan, 18. 11 Journals go to five West India Islands, 8 to New Zealand, 36 to South Africa, 52 to Canada, 51 to Australia, and then the large number of 602 to our brethren in the States, and 2,200 odd to ourselves. We may therefore claim to be world-wide benefactors. In 1898 we have 542*l.* beyond our expenses, and also 320*l.* from entrance fees and life compositions, for investment. But I must add that the 542*l.* will be absorbed in the extra cost of the Collective Index, beyond the 5*s.* charged to the original subscribers; but we believe that this Index, which is now complete and has been issued, supplies a great want. It has been made with great care, and forms a very valuable addition to the Journal. The Journal itself grows larger year by year, and has cost 350*l.* more than last year. Other expenses grow also. You will see by the balance-sheets that if it were not for advertisements and sales of the Journal we should not have any balance. Let me recommend our good friends to think of the advertisements and their world-wide distribution. Another 500*l.* from good advertisements would do them good and the Society also. Members could help also by inducing their friends to become members of the Society. I must mention a printer's error which there has been no opportunity of correcting. It is one that must puzzle anyone carefully looking at the figures. There is a note at the bottom stating that the "publishing" is for "ten months only," but giving the time Nov. 1896 to Aug. 1897. It was a note in pencil appended to a comparison of 1897 accounts with 1898, and should not have been printed; the facts are that only *ten* months were charged last year (1897), but this year (1898) includes *fifteen* months to the end of November. You will see also that there is 9,700*l.* stock invested, and that the cash account and certificates have been examined and certified by the accountants. We also have now 2,500*l.* on deposit. I will not detain the meeting longer, but shall be pleased to answer any questions.

Dr. G. **Schack-Sommer** referred to the 350*l.* which was put down in the report as an increase of the Journal expenses. Was that not, he asked, accounted for by the fifteen months' printing as against ten months' printing?

Mr. **Hall** explained that last year, 1897, the account for publishing was 1,589*l.*, and this year it was 1,828*l.* The cash statement showed that the publishing accounts this year were 2,137*l.*, and last year they were only 1,374*l.*, being a difference of nearly 800*l.*; and that was for the extra five months beyond the ten months of last year.

Mr. W. **Crowder** said he would like to know what was the actual expenditure upon the Index from first to last. He saw in the first year it was 361*l.* 2*s.*, next year 102*l.* 13*s.*, next 100*l.* 10*s.*, and this last year it had been the same, 100*l.* 10*s.*, making in all 664*l.* expended. Was there any charge above this 664*l.*?

Mr. **Hall**, continuing, said the whole of the printing of the Collective Index had yet to be paid for. That would raise the cost to about 1,200*l.* Altogether it would cost something like 1,280*l.* That was for 2,500 copies; they would cost about 10*s.* apiece. The charge was only 5*s.* to the original subscribers, and that difference would absorb the profit made last year.

The **President** said it was unnecessary to adopt the report, because the accounts were passed by the auditors.

Thanks to the Hon. Treasurer.

Prof. G. G. **Henderson** (Glasgow): I have very great pleasure in proposing that a very cordial vote of thanks be accorded to the Honorary Treasurer for the statement which he has just given. He has given a very satisfactory statement. A mere glance at the figures show that to act as Chancellor of the Exchequer of this Society is no light task. The Society may congratulate itself on having secured such an admirable successor to our former lamented Honorary Treasurer. If the Collective Index had cost 5,000*l.* or even 10,000*l.*, it would have been cheap at the money.

Dr. C. A. **Kohn** (Liverpool): I have very much pleasure in seconding the vote of thanks to our Honorary Treasurer, and I think we can all congratulate him most heartily on the successful issue of his first year of office. The least we can do to show our appreciation of what he has done for the Society is to act on his suggestion and that of the Council, to help him, firstly, by advertisements, and secondly, by appealing personally to our friends to increase the roll of membership in the Society.

The motion was carried by acclamation.

Mr. **Hall**: I thank you most cordially not only for the vote of thanks, but for the general way in which you have received me as Treasurer in the place of my late brother-in-law. It has been a great gratification to me to try to carry on that work, and your approbation of the way in which that has been done fully recompenses me for any trouble I have taken in the matter.

The Next Annual Meeting.

The **President**: The chairman of the London Section, Mr. Redwood, is with us to-day, but he has to leave by train within an hour. Therefore I think we should take the resolution which stands in his name at this stage.

Mr. **Boverton Redwood** (chairman of the London Section): In accordance with the usual procedure, the next meeting of the Society will be held in London; and, as chairman of the London Section, it is my privilege to invite the members of the Society to assemble in that city. Those of you who are not members of the London Section are many of you, nevertheless, called to London not infrequently by your avocations, and are, in a sense, at home there. To such of you it will be superfluous for me to say that, should you decide to accept this invitation, we shall do our best to make you feel at home; and to all of you I can say that, if you go there, we shall at any rate strive to make you happy. The year 1900 will be a memorable one, because of the holding of the great Exhibition in Paris, which will call together from all parts of the world a number of men of high distinction, and there can, I think, be no question that the opportunity will be availed of to hold, in connection with that Exhibition, a number of congresses of various descriptions. You will have observed, in the report of the Council, a reference to one of such Congresses, in the statement that the next Congress of Applied Chemistry will be held in Paris in August next year, and that the Council has thought fit to appoint Mr. A. Gordon Salamon and Dr. Messel a committee to confer with the authorities of that Congress in relation, as the report states, to the securing of a larger representation of British applied chemistry on that occasion. It was in the minds of the Council desirable that such action should be taken as would admit, if possible, of an active participation by this Society in the work of the Congress to which I have alluded. I need not tell you that the Congress will have as its president, Prof. Berthelot, and as its acting-president Prof. Moissan. The Congress is certain to attract a large amount of attention, and it was felt desirable that, through the medium I have indicated, communication should be opened up between the Society and the acting-president. I am not yet in a position to say what form the participation which we desire will take, nor can I say for certain whether it will be practicable to arrange for such participation; but I have it on the authority of Mr. Gordon Salamon—who regrets very much that he is unable to be here to-day—that Prof. Moissan has received very favourably the proposition in question, and that there is good reason to believe that this Society will be invited to Paris next year. If that anticipation should be realised, it is obvious that the meeting next year will assume a somewhat unusual form—a form which cannot fail to be pleasing to the well-wishers of the Society, and full of enjoyment to those who are able to participate in what is projected. I cannot, as I have said, indicate with any degree of precision how such a desirable arrangement can be carried out. But I do wish to make one remark in reference to the subject, namely, that I hope that, if we are able to give effect to what, as you will see, is in the minds of the Council in relation to this matter, the more serious side of the project, if I may so put it, will not be overlooked, and that members of the Society will in good time begin the preparation of papers suitable to be communicated to the Congress in question. I have only, therefore, to extend to the members of the Society a very cordial invitation to assemble next year in London, coupling with it an expression of the hope that, under the conditions which I have ventured to allude to—necessarily with great reservation—it may be practicable, immediately after the conclusion of the formal business of the Society, to adjourn to Paris. I conclude by formally moving that the next Annual General Meeting of the Society of Chemical Industry be held in London.

Mr. B. E. R. Newlands (London) seconded the proposal.

Mr. Thomas Tyrer: I do not exactly see how I can add anything to the cautious but nevertheless clear indications of our chairman, Mr. Redwood. But you know I have had some experience in these matters. This matter of the direct association of the Council with the International Congress of Applied Chemistry is a coincidence of a most fortunate character. It accentuates the position, and we have all a reason for saying "Yes" to the question. As to the details, all will be in the hands of the London Committee, and you may be quite sure we will do all we can. Some proposal of that kind, and the means for it, would have been in any case considered very fully, as matters have assumed a very decisive character; and if they are approved it will be incumbent upon us in the London Section and Committee to do our very best. One may go a little further, and say this: that it is our duty obviously to make your time in Paris pleasant and profitable. Therefore, a considerable amount of organisation will be necessary. We should make some collective arrangement by which the whole Society shall not be scattered, but shall be focussed somewhere conveniently and happily, so that we may really have a thoroughly fraternal meeting.

The motion was carried.

The President: Before I avail myself of the privilege which you give your President on this occasion, I should like, informally, in one or two words, to express the gratitude that I feel to everyone connected with the Society for their extreme kindness to me—to my colleagues in the Council, to the members of the sections which I have had the pleasure of visiting, to the Hon. Treasurer, to the Secretary, and to the Editor, I wish to express my hearty thanks.

The President then read his address as follows:—

THE PRESIDENT'S ADDRESS.

The output of coal in the United Kingdom for the year 1898 was 202 million tons. The exports for that year are stated to have been, in round numbers, 45 million tons, leaving for home consumption 157 million tons. The rapid growth of this huge figure is brought under our notice from time to time by economists and mining engineers, who tell us that our coalfields will be practically exhausted in from 30 to 50 years. The presidential address of Mr. J. A. Longden at the Annual Conference of the Institution of Mining Engineers in May last is the most recent authoritative utterance on the subject, and is well worthy of the serious consideration of all who are interested in the industrial prosperity of the country. The development of the output of coal during the nineteenth century has been remarkably rapid, having risen from 10 million tons in the year 1800 to 200 million tons in 1898. When we are told that, by the middle of next century, the output will probably have fallen back to a smaller figure than it had reached in 1850, we begin to realise how small a portion of our national history the British coal period will cover. It is but right that we should also realise the great changes in our industrial position which will result from our having, in the not very remote future, to carry on our manufactures with imported fuel. The subject has more than an academic interest for us as a society, when we remember that the younger members of to-day may actually have to deal with the new state of things. Certainly the future life on these islands will have to depend more and more on the ships and over-sea means of communication if our fuel as well as our food has to be brought to us from abroad. The engineers and shipbuilders of to-day, who are improving these means of transport, are entitled to feel that they of all others in the nation are working for the good of posterity, as every advance made in these directions is making more possible a continued life of freedom and independence on our islands.

While the increasing amount of coal which we are burning as fuel is intimately associated with our industrial prosperity, it is also responsible for the fact that smoke pollution is pressing itself more and more on our attention. The concentration of works not only in and around our large cities, but also in the rural and suburban districts around these cities, is telling very seriously on the purity of the air. As a result of almost daily observation of the condition of the atmosphere over the belt of country which extends across Scotland from the Firth of Forth to the Firth of Clyde, I have come to the conclusion that a general condition of smoke haze is much more prevalent now than it was 10 to 15 years ago, and that days of brilliant clearness are less common now than they were then. There is evidence that the experience of other observers confirms this conclusion.

A valuable literature on the subjects of fuel and smoke lies buried in the past volumes of the various technical societies, as well as in reports and Blue Books. Our own Journal contains so large a number of papers on this and on subjects nearly related to it, that it is not possible for me to refer to them even by name, still less would it be possible to give any adequate idea of the ground covered by these separate reports and papers. I am sure you will believe that this omission indicates no want of appreciation of the debt we owe to the earlier pioneers as well as to the more recent workers, to all of whom I wish here and now to acknowledge my indebtedness, as, apart from their work, there would have been little or nothing for me to say on the subject to-day.

Broadly, the subject has been treated from two points of view. The first includes the scientific investigation of chimney smoke, and the means of measuring it and its immediate effects. The second is directed to the investigation of the various remedies which have found favour from time to time. Recent articles by Mr. Bryan Donkin in *The Engineer* have admirably summarised the latest advances in the accurate observation and measurement of smoke emission from chimneys. I think it must be admitted that the smoke inspector of to-day is now fairly equipped with means by which he may estimate and classify the various degrees of smoke emission. For the benefit of those who may not have seen the articles referred to, I reproduce on the screen the diagrams with which Mr. Donkin illustrates his paper, an abstract of which will appear in the August number of the Journal.

After studying a good deal that has been written on these questions, it has struck me that they have reached a stage at which they may, with advantage, be treated together on a broad general plan and "to scale." Those of us who have to do with works and plant are in the habit of putting down our first ideas of any new apparatus in the form of a rough hand sketch, which we alter and modify as one consideration after another strikes us. When the idea is evolved up to a certain point, we find it necessary to apply to it the control of exact dimensions, by making a carefully measured scale drawing. Only when our plans are drawn to an exact scale can we be certain that no errors of proportion have been made, and that no important element has been lost sight of. We may fairly enough apply this analogy to such a subject as that with which we are dealing. While our ideas are at the "hand sketch" stage, it is only too easy to go wrong in a problem which involves many issues, any of which may profoundly affect the whole question; the only safe plan is to state the whole problem broadly, and with its parts in true relation and proportion to each other. With the scale plans before us, it may be that solutions of the problem may occur which would otherwise have escaped us, while other solutions, which appeared feasible enough in the "hand sketch," will be found to be impracticable when all sides of the problem have to be taken into account.

Perhaps I am wrong in supposing that the subject of fuel and smoke has reached the stage at which it is possible to treat it in this way, and my knowledge and experience may prove unequal to the task. The task is a large, but, I venture to think, a worthy one. May I express the hope that, should I fail to accomplish it satisfactorily, my failure may only inspire others, with a better equipment of skill and experience, to carry on the task?

The root of the smoke evil exists in the raw coal we burn as fuel, and its full fruition is insured by our methods of burning the same. These methods vary according to the purposes for which the heat of the fuel is required. The first step, therefore, in the treatment of the subject "to scale" is to apportion the total amount of coal consumed under various heads, according to the purposes for which it is consumed. While official figures for the total output and exports of coal for the United Kingdom are available, there are no equally trustworthy figures to be had for the distribution of the home consumption over the various industries of the country. Various estimates of these have been published from time to time, and I have taken some pains to go over certain of these estimates, and to check them as far as possible by the statistics of various well-known industries. As a result, I have arrived at the estimate which is given on Table I. This estimate is not to be regarded as accurate for all purposes, but I believe it may safely be taken to indicate the comparative magnitude of the various parts of the fuel and smoke problem.

The total coal consumed in the United Kingdom in 1898 was 157 million tons, of which—

76 million tons were consumed for the production of power for industrial purposes;

46 million for the production of heat for industrial purposes;

35 million for the production of heat for domestic purposes.

Taking the first two items more in detail, it is estimated that for the production of *power*—

Railways.................	consume	10 to 12 million tons.
Coasting steamers..........	,,	6 to 8 ,, ,,
Mines......................	,,	10 to 11 ,, ,,
Factories..................	,,	38 to 40 ,, ,,

For the production of *heat* for industrial purposes—

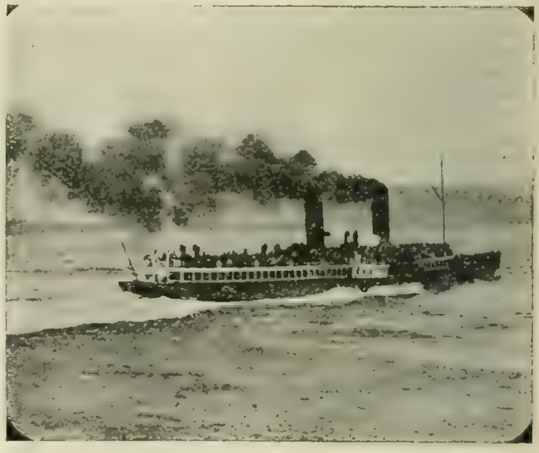
Blast furnaces..............	consume	16 to 18 million tons.
Steel and malleable iron works..................	,,	10 to 12 ,, ,,
Other metallurgical works.	,,	1 to 2 ,, ,,
Chemical works, potteries, and glass works..........	,,	4 to 6 ,, ,,
Gas works..................	,,	13 to 14 ,, ,,

With these figures before us, we are in a position to study the subject in a practical way, and not only to gauge the extent of the evil and to apportion the responsibility for it, but also to appreciate the importance and practicability of the proposed remedies.

Coal used for Power Production.

Railway Locomotives consume** 10 **to** 12 **million tons of coal per annum.—When the lines of railway pass through a thinly peopled country, the effect of the smoke from the locomotives is very little noticed. But if the vegetation near the line is periodically examined throughout the summer, it will be found that a steady deposition of soot is going on all the time. After carefully watching the exhaust from locomotives, I have come to the conclusion that the effect of the very large emission of soft steam with the smoke is to cause it to deposit quickly and within a comparatively short distance of the line. This, I imagine, is a result of the vigorous vortex currents produced by the rapid puffs of steam rather than an effect of condensation. As a rule, in fact, the steam disappears by solution in the atmosphere, not by condensation; it does not condense into the liquid state except in a very damp condition of the air. In the neighbourhood of large towns, where the railway system becomes more concentrated, the smoke effects must be correspondingly increased, though they are less easily distinguished among the other sources of pollution.

River and Coasting Steamers burn** 8 **million tons of coal per annum.—Probably the larger part of this 8 million tons is consumed in deep sea coasting steamers, which distribute their smoke over a wide area of sea well out of reach of land. But that smaller part which is consumed by steamers on tidal rivers and in land-locked waters results in smoke pollution out of all proportion to the amount of coal burned. In the case of a well-known and most picturesque Scotch river on which a large fleet of swift steamers ply for six days out of seven, the pollution has reached a very serious point, and the emission of dense black smoke is so unblushingly practised that one would think that a popular movement for its suppression cannot be long delayed. When the atmosphere is at all stagnant, this smoke forms a veil over a wide district, which steadily increases in density from Monday morning till Saturday night. The welcome change of atmosphere on Sunday ought at least to provide an instructive object lesson to those who are concerned with the matter.



Steam Boilers at Mines, Mills, and Factories consume** 50 **million tons of coal per annum.—The class of land steam boilers includes within it a very varied assortment of coal consuming apparatus. For convenience it ought to be divided into two sub-classes—"the hopelessly smoky" and "the potentially smokeless." We all know the contractors' vertical boiler which haunts districts in which building operations are in progress. We also know the egg-ended boiler in the backyard of the small city factory, badly built, and set with no flues or chimney to speak of, gorged with coal every few hours, and left to itself between times. Not less familiar to us is that form of electric lighting installation which is founded on the multitubular boilers of extinct threshing machines, surmounted by exaggerated stove pipes, which wake up towards evening to spout Indian ink over the entire landscape. These all belong to the "hopelessly smoky" class.

But let us be thankful that we are also familiar with the full-sized Lancashire boiler, set in ample flues, and ranged with its fellows in a convenient boiler shed, in which the coal is sorted so that stoking may be practised as an art, bringing credit to the stoker and saving money to his employer. If we do not possess such an installation ourselves, I trust, if we are manufacturers, that it is our ambition to do so. Such boiler installations are to be classed as "potentially smokeless."

It has been matter of common remark that the generation of electricity for lighting purposes is very often accompanied by the generation of volumes of the densest black smoke. Surely the light which is intended to purify and sweeten our homes is obtained at too great a cost if it is to involve the pollution of the atmosphere and surroundings of these homes. While electric lighting was making its *début* at international and other exhibitions, we may have felt it only courteous to the *débutant* to do our best to ignore the hideous array of smoke-belching stove-pipes which generally occupied the rather too obvious background of the spectacle. But electric lighting is now an accepted fact, and the public has a right to insist that the municipal and private installations which are being laid down regardless of expense should be so planned and designed that their steam raising may be a model of all that is best and least offensive, instead of exactly the contrary, as is so often the case at present.

Under this head of consumption it would have been interesting if we could have distinguished more precisely between the coal which is used to raise steam for power purposes and that which is used to raise steam for heating purposes, but it is, unfortunately, quite impossible to do so. The total number of steam boilers in use in the United Kingdom is estimated at about 150,000. If the 50 million tons of coal which is burned for steam raising is equally divided over these 150,000 boilers, it gives 333 tons for each, or about 1 ton per working day. As a full-sized Lancashire boiler will easily burn from 4 to 5 tons per day of 12 hours, this must be regarded as showing that the average boiler is not overworked. If the whole of the 50 million tons of coal were burned for power alone, it would give, at a consumption of 6 lbs. per horse-power per hour, 5 million horse power, for 300 days of 12 hours each. We know that, at any rate, a very considerable part of this 50 million tons is used to produce heat, not power, therefore we may conclude that the total horse-power used in mills, factories, and mines must be under 5 million horse-power.

Some of the best and most recent works on smoke prevention has been directed to this matter of steam raising. In 1893 the Glasgow and West of Scotland Smoke Abatement Association issued a report on the subject after conducting, through their engineer, an elaborate series of tests on the firing of Lancashire boilers by hand and by means of mechanical stokers. The conclusions arrived at in that Report are well worth reproduction here, but for the special object of this address I will only quote the final paragraph:—

"Finally, the committee are of opinion that, whilst future experiments and inventions may be the means of introducing new and better methods of treatment in the combustion of fuel, enough is known at present to enable steam users to work their boilers with a fair degree of economy and practically without smoke."

In 1895, the Manchester committee for testing smoke-preventing appliances issued its report after five years of practical work and investigation. In this report we are informed that this committee was the outcome of (1) a suggestion made by the chief inspector under the Alkali Acts, Mr. A. E. Fletcher, in his annual report for 1888; and (2) a prior correspondence in the ***Manchester Guardian***, in which Mr. J. W. Holden and Mr. R. Forbes Carpenter urged the need for further authoritative information as to the capabilities of the various smoke preventing appliances in the market. This Association carried out its practical work in the department of steam raising, but the report contains also some interesting information as to some other departments of industry, which will be referred to later. The conclusions of this committee as to smoke produced in raising steam, are summed up in the following sentence:—

"A manufacturing district may be free from manufacturing smoke—at least from steam boilers, with which alone the committee have concerned themselves—and as to the means by which it may be so freed, the report contains ample information."

These conclusions fully justify the inclusion of the better class of steam boilers as "potentially smokeless." What steps are required in order to transfer them into a further class of the "actually smokeless" we may inquire at a later stage.

Gas Works consume 13 *million tons of coal per annum.*—The whole of this large amount of coal is handled smokelessly, and is converted in the gas works into illuminating gas, coke, tar, and ammonia.

Blast Furnaces consume 16 *million tons of coal per annum.*—In England, coke is the fuel used in blast furnaces. This coke is chiefly made in beehive ovens, no attempt being made to recover the volatile products of distillation.

About 1¼ million tons of coal is converted into coke in recovery ovens, the volatile products from which are very similar to the gas works' products.

Progress is being made in the replacement of beehive by recovery ovens, but the rate of displacement in this country is slow as compared with the rate on the Continent.

The Scotch blast furnaces consume about 2 million tons of coal per annum. During the past 15 years most of these furnaces, about 74 in all, have been fitted with apparatus for collecting, washing and scrubbing the gases from the top of the furnace, so that tar and ammonia are recovered.

Malleable Iron and Steel Works consume at least 10 *million tons of coal per annum.*—Raw coal is still used to a considerable extent in this industry, and often with a very serious production of black smoke. The labours of Siemens, Head, and others, have so thoroughly established the fact that fuel gas can replace raw coal, not only without loss, but with gain in every direction, that it is disappointing to see such a very serious amount of smoke pollution still coming from this source.

Tin, Lead, Copper, and Zinc Works consume from 1 *to* 2 *million tons of coal per annum.*

Chemical Works, Glass Works, and Potteries consume about 5 *million tons of coal per annum.*

In both of these classes there are operations in which a reducing flame of a smoky character is thought to be necessary, but in the majority of chemical and metallurgical operations, fuel gas or other smokeless fuel might be advantageously used.

The indirect advantages of gaseous fuel, such as cleanliness, ease of adjustment, and reduction of wear and tear, make it specially suitable for use in these operations.

With reference generally to the production of heat for industrial purposes, there are several interesting paragraphs in the Manchester Report of 1895, pp. 22—23.

Domestic Fires consume 35 *million tons of coal per annum.*—In point of magnitude this item of consumption ranks next to steam and steam power. In spite of the fact that gas companies are supplying a considerable quantity of gas and coke for heating and cooking in private houses, this enormous consumption of raw coal in domestic fireplaces seems to go on increasing. The figures of consumption in Table I. are not sufficiently accurate to enable us to say to what extent the increased consumption of gas, which is so clearly shown by gas statistics, has checked the natural increase of coal consumption for domestic purposes. The figure before us, however, is sufficiently startling; we are consuming in the United Kingdom nearly a ton of coal per annum for every man, woman, and child of the population. In no other country is the consumption per head anything like so high, and yet the Continental countries have to contend with a very much lower winter temperature, and in several of them the climate is as damp as that of Britain. We can hardly study this figure without being forced to the conclusion that we burn two to three times as much coal as we need to for the proper heating of our houses. That this

35 million tons is not burned smokelessly has been amply demonstrated. It has even been suggested that domestic smoke is answerable for a greater amount of atmospheric pollution than industrial smoke. However that may be, it is quite certain that no treatment of our subject can be considered complete which does not fully recognise this large and important item of our national fuel consumption.

Having thus briefly reviewed the broad facts and figures of our British coal consumption, we are in a position to consider the bearing on these facts of our modern knowledge and experience of the handling and transforming of raw coal. Here, also, we shall be safe only if we treat the subject with due regard to scale and proportion. So far, one result of our review is to show us that there is great variety in the sources of smoke pollution, and we must at once conclude that no one remedy is likely to meet all these varied causes. In the past history of our subject there have been many cases in which excellent proposals or suggestions have been prejudiced by being put forward as more widely applicable than was actually the case. But if we have an advantage to-day, it is that the suggestions of the past 20 years are before us, not in their originally isolated and unsupported form, but with a wealth of experience added to them.

The Remedies for Smoky Combustion.

First—*Mechanical Aids to Combustion.* Second—*The Manufacture of Smokeless Fuels.*—There are two classes of suggested remedies for smoky combustion. The first of these has for its leading idea the providing of special appliances to effect the smokeless combustion of raw coal. In the second, the leading idea is to transform the raw coal into smokeless forms of fuel by preliminary treatment.

Remedies of the first class have been applied most successfully to steam boilers and ovens, in which there is a large and fairly regular consumption of raw coal. To this class belong the various forms of mechanical stokers, in which careful hand stoking is successfully imitated by automatic machinery. By this system the supply of fuel is so regular that the chimney draught and the air supply can be adjusted once for all, so as to give a practically smokeless combustion. Mechanical stokers are constructed on two systems, which are respectively known as "coking" and "sprinkling." In coking stokers the fuel is passed in at the front of the furnace, where it gives off its gases, which burn as they pass over the stretch of glowing coke in the inner part of the furnace. By a movement of the fire bars the coal is gradually passed inwards along the furnace, so that those portions which have parted with their volatile matter in front of the furnace become in turn the glowing coke which ignites the gases from the coking of the succeeding portions. Sprinkling stokers distribute the fresh coal over the whole surface of the furnace, but so gradually and uniformly that the glowing surface of the coke fuel is never chilled to the smoke-producing point. I understand that mechanical stokers of a very satisfactory and trustworthy character are now being produced. Such defects as were found in the earlier machine have been gradually eliminated, so that increased durability and diminished cost for upkeep have been secured. I am also informed that the limits of throughput between which these stokers will work economically and smokelessly have been widened, till it is now possible to vary the rate of consumption 75 per cent. on the maximum throughput; that is, the throughput may be dropped from 100 to 25 without interfering with the economical and smokeless working.

Belonging to the same class of aids to smokeless consumption of raw coal are the various contrivances by which the air supply to the furnace is broken up and delivered at the several points where it is most likely to ignite the gases from the green coal. In same cases an attempt is made to heat the air before it reaches the combustion point. These appliances are valuable adjuncts to careful stoking, whether hand or mechanical, but they are quite valueless as smoke remedies unless good stoking is ensured.

My own experience as a steam user entirely coincides with that of the committees in this country and abroad which have investigated the working of steam boilers smokelessly, namely, that with boilers properly designed and built, and of ample power and skilfully fired, smoke production from this source may be reduced to an absolute minimum. Certainly if the whole of the 50 million tons of coal which is yearly consumed for steam raising were burned as inoffensively as it might be in the best form of steam boiler, the nuisance would be so trifling that we might safely leave any further improvement in that department to wait till the other sources of the nuisance had been brought up to the same high level.

There can be no doubt that great benefit has resulted from the Government inquiry into the causes of steam boiler explosions. The insurance of steam boilers, which became a practice after that inquiry, and the regular inspection which is made a condition of such insurance, has tended to bring the design, the setting, and the management of boilers up to a much higher level. The whole of this work has been carried out in an unobtrusive way, but the benefit to industry at large has been very great. I cannot help thinking that a like benefit would result if the Government could bring a little gentle pressure to bear on steam users, such as would lead to the gradual weeding out of unsatisfactory and overworked boilers, as well as to the training and registration of stokers.

The second class of remedies includes the various methods for the preliminary preparation of raw coal so as to convert it into smokeless forms of fuel. These may be further subdivided into "destructive distillation" and "partial combustion" methods.

Destructive Distillation. — There are two principal methods for the destructive distillation of coal in ordinary use—gas retort and coke oven distillation. Gas retort distillation is conducted primarily with the object of making good illuminating gas, the other products of the distillation being of secondary importance. Coke oven distillation is conducted primarily with the object of making good coke, the other products being, as a rule, completely neglected and lost because there are many iron makers who believe that the recovery of the products of distillation is not consistent with the manufacture of the kind of coke which is most suitable for the blast furnace. But in the inquiry in which we are at present engaged our interest in coke oven distillation is not bounded or limited by its application to the 13 million tons of coal which is coked in beehive ovens for the manufacture of pig iron. That is a matter which chiefly affects the iron maker. We must consider it in its much wider application to the treatment of at least a part of the 130 million tons of coal which at present is burned in the raw state.

It is not in the least necessary for me at this time to enter into any detailed description of the various forms of recovery coke ovens which have been on their trial now for 12 or 15 years, and which have, during that period, been carefully developed and improved by the gradual elimination of weak points in their construction and management. The details of this evolution have been communicated from time to time to our various technical societies, and any one who is interested in the subject can have the fullest opportunity of mastering it for himself. Neither is it necessary for me to go into the details of modern gas works practice. That evolution is to be found fully chronicled in the technical journals which are specially devoted to the gas industry. For our present purpose it is only necessary that we should have before us the salient points of each of these methods of distilling coal.

As I have already said, a special character has been given to each of these methods by the particular products which it is the primary object of each to produce in the greatest perfection. The high standard of illuminating power which the gas engineer aims at producing in the principal product of his retorts involves the use of special coals, as well as the handling of the coal in a special way. The gas retort is worked with small charges of coal thinly spread over the bottom of a capacious retort. These small charges are quickly worked off in from five to six hours. The coke produced by the gas retort is light and spongy, and is therefore unsuitable for blast furnaces or foundry purposes, where hardness and density are first requisites. A portion of the gas retort coke is used for firing the retorts themselves, and the remainder is used for heating purposes by local industries. For instance, a large part of the coke produced in the London Gas Works is used in the cement works of the Medway.

The necessity for charging and drawing the retorts every few hours makes the cost for labour high, as compared with systems of distillation in which the coal is handled in larger quantities and at longer intervals of time. This cost has been considerably reduced by the replacement of hand charging by "mechanical" charging. The mechanical charging and drawing machines of West and of Arrol and Foulis are now very widely used. The setting of the retorts at a considerable angle with the horizontal, to facilitate the spreading and drawing of the charge, is another means of reducing the cost for labour. Still, even with these improved methods, the system of short charges has serious disadvantages. Skilled chargers and drawers must be in attendance for the whole of the 24 hours, while the frequent opening of the retorts involves a serious loss of heat, which has to be made good by burning a larger proportion of the coke than would otherwise be necessary.

In the recovery coke oven the primary object has been to obtain a coke equal in density and hardness to the product of the beehive oven. This has been attained by making the ovens narrow and deep, and by maintaining the walls at a very high temperature. The coal is dropped into the oven through hoppers on the top side. This enables the charging to be done quickly and cheaply. The ovens, being nearly filled to the top with coal, the pressure due to its own weight keeps the coke dense and compact. The ovens are generally heated by burning a portion of their own combustible gas in flues formed between the main walls. The charging is done at intervals of from 24 to 48 hours, according to the size of the oven and the quality of the coal. With charges of four to five tons for each oven, and with such long intervals between the charges, it is evident that the cost for labour per ton must be much smaller than it is in gas retort distillation.

The recovery oven of to-day has been evolved along its present lines because the main object was to obtain a dense hard coke for metallurgical purposes. In spite of this important limitation, it has been developed into a fairly economical machine for the separation of the volatile and non-volatile constituents of coal. May we not hope that, if it becomes desirable to separate the volatile and non-volatile constituents of any considerable portion of the 130 million tons of raw coal without this limitation as to the quality of the product, that methods for doing so may be devised which will be even cheaper than the present recovery oven?

At this stage it is desirable that we should pause to consider what would be the probable effect on the by-product markets if any great extension of coal distillation were to take place. Taking stock of the position, we find that—

Gas works distil 13 million tons, and produce—
  130,000 million cub. ft. of illuminating gas at 650 B.T.U. per cub. ft.;
  650,000 tons of tar;
  129,500 tons of sulphate of ammonia;
  7 to 8 million tons of soft coke.

Blast furnaces distil 2 million tons of coal, and produce—
  360,000 million cub. ft. of fuel gas at 130 B.T.U. per cub. ft.
  150,000 tons of tar;
  18,000 tons of sulphate of ammonia.

Recovery coke ovens distil $1\frac{1}{4}$ million tons, and produce—
  12,500 million cub. ft. of illuminating or fuel gas at 600 B.T.U. per cub. ft.;
  62,000 tons of tar;
  900,000 tons of hard coke;
  11,000 tons of sulphate of ammonia.

If beehive ovens were entirely replaced by recovery ovens, there would be a further production of—
  125,000 million cub. ft. of illuminating or fuel gas;
  620,000 tons of tar;
  9 million tons of hard coke;
  110,000 tons of sulphate of ammonia.

Collecting these figures together, we have from—

—	Tar.	Sulphate of Ammonia.
	Tons.	Tons.
Gas works	650,000	130,000
Shale oil works	..	37,000
Blast furnaces	150,000	18,000
Recovery ovens	62,000	11,000
Present totals	862,000	196,000

The 862,000 tons of tar is again distilled and separated into 474,000 tons of pitch and 345,000 tons of oil. Pitch is used for building, roofing, and road making, and a considerable quantity is used in making briquettes. From the oil distillate there are further separated:—Benzol, naphtha, anthracene, naphthalene, and phenol compounds, the balance being sold as tar oils of various grades which are used for burning in furnaces or in lucigen lights, as well as for lubricating and similar purposes. The additions to these products which would result from the further replacement of beehive by recovery ovens would disturb the existing markets very seriously. With the increased production of recent years, the prices of such products as benzol and anthracene have fallen so much that their recovery does not always pay. But if any considerable part of the 130 million tons of coal which is at present burned in the raw state were to be distilled, it is perfectly evident that a new condition of markets must arise. When this new situation arises, no delusions must be cherished as to the possibilities of tar products. The "Benzol Chain" cannot be the salvation of the greater gas industry of the future, as it has been of the lesser industry of the past. No conceivable growth of the most perverted taste for bright colours could possibly lead to the absorption as dyestuffs of the hydrocarbons from 50 million tons of coal, even if to artificial dyes we were to add artificial narcotics and febrifuges of all kinds! No; such enormous quantities of material can only find an outlet by being converted into energy as fuel. As fuel, the ultimate value of the by-products must always bear a certain ratio to the value of raw coal. With a raw coal value of 1, the products may vary in value from $1\frac{1}{2}$ to 3, according to circumstances. Liquid fuel will have a value of $1\frac{1}{2}$ to $2\frac{1}{2}$; gas of 600 B.T.U. per cub. ft.—a value of 2 to 3; coke and briquettes a value of 1 to $1\frac{1}{2}$.

The first two forms of fuel would almost at once command free and steady outlets at prices based on these ratios.

It is probable that there is room for the cultivation of the outlets for coke as such; but it is doubtful if coke will ever be a generally acceptable fuel for miscellaneous purposes. It may therefore be necessary to find fresh outlets for the disposal of coke if a much larger quantity is to be produced.

The manufacture which would seem most happily to supply the necessary outlet both for the coke and for the pitch, which would result from the more extensive distillation of coal, is that of fuel briquettes.

During the past year or two, since the subject has been specially before me, I have been increasingly struck with the rôle which the briquette might play in the fuel of the future. My personal experience of the briquette of commerce had previously been limited to such stray specimens as had found their way to my fireplace, where their general behaviour was so bad as to lead to their prompt condemnation. In the first place, the brick was much too large and massive to take fire when it was placed on any but a fire of the first magnitude. In the second place, having no cleaveage, it absolutely refused to break down under the poker in any reasonable way; and, in the third place, when it ultimately consented to smoulder a little, it did so to the accompaniment of a peculiarly offensive yellow smoke. To this domestic experience of the fuel briquette must be added the further experience of its horribly smoky qualities as these are developed on the locomotives of Italy and Switzerland, where, when one complains of the excessive dirtiness of the trains and their appointments, one is generally assured that the cause is the patent fuel.

Having these strong prejudices in my mind, I was rather taken aback during my study of this subject, that the further I pursued it the more necessary did the briquette seem to become as the one means by which the by-products of coal distillation on a really large scale could be rationally disposed of as fuel.

Being forced, therefore, to consider the subject *de novo* and impartially, it was not long before I arrived at what now appears to me to be the most simple and natural of propositions, namely, that the *fuel briquette will be just exactly what we choose to make it.*

At present, briquettes are generally made by compressing a mixture of ground coal and pitch, the pitch being used as a cementing material. Naturally, the briquettes made in this way must partake, to a very large extent, of the qualities of the coal of which they are chiefly composed—a smoky coal will yield a smoky briquette, while a clean burning coal will give a clean burning briquette. But under any general system of separating the volatile and non-volatile constituents of raw coal, the most natural material from which to make briquettes would be the coke or partial coke produced by this separation. These briquettes would be more like an anthracite than a bituminous coal, and would burn practically smokelessly. By suitable variations in size and shape, they might be made quick or slow burning. Preliminary grinding and washing of the coal before distillation would serve the double purpose of reducing the mineral matter and ash, and securing homogeneity in the material of the briquette.

Most of us can look back to a time, not so very long ago, when the washing and sizing of small and waste coal was hardly practised at the pits, and when slack of a very inferior quality was sold at ruinously low prices. During recent years we have seen this state of things completely changed, and are, therefore, encouraged to expect that colliery proprietors, having found the benefit of the more careful handling of what used to be almost a waste product, will now be prepared to go a step further in the same direction, and to co-operate with the coal distiller in placing on the market briquettes of every quality, to suit the needs of the various consumers, be they steam users, metallurgists, or householders.

It remains now to consider the probable effect on the ammonia market of a largely increased production of sulphate from the distillation of coal or its incineration in gas producers. On this subject it is necessary to speak with the greatest caution. But this is really a case in which one is more likely to see the broad tendencies correctly than the temporary turns and twists of the markets. Those of us who have watched the fluctuations of sulphate know only too well how impossible it is to predict how prices will move in the immediate future. The first obvious tendency to be noted is the increasing appreciation of ammonia by the agriculturist. From this and other symptoms, we are entitled to expect that the ultimate outcome of the rival claims and pretentions of nitrate of soda and sulphate of ammonia will be to establish the value of the two in something like the ratio of their nitrogen value. It is unlikely that sulphate will ever again take a subordinate place to nitrate, but it is equally unlikely that sulphate will be maintained at a price above its proper ratio to nitrate. I am inclined to believe that, under the present condition of things, it is a most serious disadvantage to sulphate that the quantity available for the market bears such a small proportion to the output of nitrate of soda.

A commodity which is practically an equivalent for another commodity, and which bears to it so inconsiderable proportion as 1 to 5, is almost sure to be the mark for all sorts of speculative attacks. Even if this proposition is not true in the general, it has certainly been shown to be true in the particular case of sulphate for the past 20 years. If I am right in this view, then the ammonia maker will gain, not lose, by an increase of production which would place the production of sulphate more on the level of that of nitrate of soda. The maintenance of a fairly uniform price for a commodity is the only way to secure the interest and confidence of the buyer. The actual consumer dislikes very much to have to do with a material which fluctuates widely from a standard price. What chemical manufacturer, on an extensive scale, would care to do with a raw material which might fluctuate from 50 to 100 per cent. in price within six months, if he had the option of buying another fairly equivalent material which he knew by experience did not fluctuate? Would he not unhesitatingly buy the latter? May we not fairly conclude that the agriculturist will be influenced in the same way as the manufacturer?

On these grounds, then, I believe that if the ammonia producer can get the equivalence of nitrate and sulphate fairly recognised, he may safely, and even with advantage, push up his output to five times its present dimensions in the confidence that it is not he who will suffer in the long run.

A great increase in the quantity of coal treated by destructive distillation involves a corresponding increase in the output of tar oil. Oil is a most convenient and economical form of fuel for many purposes, but with the present comparatively limited supplies, its price is subject to far too serious fluctuations to make it a desirable fuel for the ordinary manufacturer to commit himself to. After a considerable practical experience of its use on a large manufacturing scale, I feel confident that steady consumers would be found for all that is likely to be made in this country at a price about double that of raw coal, say 20*s.* to 30*s.* a ton—a price at which it would be quite impossible to deliver any petroleum product in this country. What was said about sulphate of ammonia applies here also; the consumer must have a reasonable assurance that the price of his raw material will not fluctuate too violently, or he will be forced to find a more trustworthy equivalent.

If the distillation of coal is regarded simply as a step in the production of smokeless fuel, that is to say, if all that is aimed at is the separation of the volatile and non-volatile portions of the coal so that each may be burned as fuel under the most favourable conditions, the problem of distillation is very much simplified. It is at once relieved of the restrictions under which the coal-gas industry and the coking industry are at present carried on, and which add most seriously to the cost of distillation in both industries. If it is no longer a necessity that a gas of high illuminating power or a coke of a certain hardness and density be produced, cheaper methods of distillation at once become available.

The problem of how to distil a carbonaceous material most cheaply has been solved in the shale oil industry during the past 30 years. During that period the cost of handling a ton of shale from the time it leaves the pit tubs till its ash has finally been tipped on the waste heap has been reduced from 5*s.* to less than 1*s.* This sum includes the cost of labour, fuel, steam, power, and upkeep of plant. Probably the experience and the methods of the shale industry would require considerable modification to adapt them to the purposes of coal distillation, but I feel fairly confident that when the proper time arrives we shall see coal separated into its volatile and non volatile constituents as shale is at present.*

If I am right in this forecast, then it will not be an entirely profitless exercise to consider shortly the lines on which a general scheme of smokeless fuel production might be developed. The coal would be crushed, sized, and washed at the pits, so as to reduce its mineral matter and ash to a minimum. After being freed from water as far as possible, it would be taken to a central coking and gas producing station situated in an industrial locality. Here it would be distilled partly in continuous retorts and partly in coke ovens, the proportion so treated being determined by the demand for soft and hard coke respectively. The richer portions of the gas would be passed over to the local gas companies at a moderate price. The poorer portions of the gas would be distributed directly among works in the neighbourhood.

The tar would be distilled, yielding oil and pitch. The oil would be sold as fuel, and the pitch would be used along with the soft coke or small coal for the manufacture of the various qualities of briquettes.

The hard coke and a part of the soft coke would be sold directly as fuel.

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* For drawings of the Pumpherston retorts, see Appendix, pp. 6 4—665; and for description see this Journal, Dec. 1897, 990—993.

The ammonia would be converted into sulphate and sold as such.

Special chemical products such as cyanogen compounds or hydrocarbons might be made when the state of the markets was favourable. But in this scheme no dependence would be placed on the fancy prices which might from time to time be obtainable for special products. The main business would be to make and sell such forms of fuel as would best meet the wants of the market, and to do this really well.

If to this scheme are added one or more of the fuel gas processes to which reference is now to be made, our picture of the fuel manufactory of the future will be complete.

Partial Combustion of Coal for the Production of Fuel Gas.

There are two leading types of gas producer—the continuous and the intermittent. The former aims at the continuous production of a gas of a uniform quality. This is accomplished by burning the fuel in a limited supply of air, or in a mixture of air and steam. In the working of the second type of producer there are two alternate phases in the operation, namely, a heat-producing and storing phase, during which air alone is forced through the mass of fuel so as to generate heat rapidly, which heat is accumulated in the mass of fuel in readiness for the second or gas-producing stage, during which steam alone is forced through the highly-heated fuel and is decomposed, yielding hydrogen and carbonic oxide.

The first type produces a gas containing a large percentage of nitrogen and a correspondingly small percentage of combustible gases; the second type produces a gas rich in combustible gases, and containing only a small percentage of nitrogen. An average gas of this type has a heating value of 350 to 370 B.T.U. per cubic foot, while gas of the first type has a heating value of 130 to 160 B.T.U. per cubic foot. The relative efficiency, from a thermal point of view, of these methods varies from 60 per cent. to 80 per cent. That is to say, if the heat value of the coal by direct combustion is taken as a hundred, these forms of gas producers give an available yield of gas fuel having a heating value of from 60 to 80. The efficiency of the second or intermittent type of producer depends to a very large extent on the means available for recovering the heat which passes away with the gas generated during the first or blowing-up stage of the operation. Owing to the great depth of fuel through which the blast has to pass in these producers—often as much as 8 to 10 feet—a considerable amount of the carbonic acid produced at the bottom of the column is reduced to carbonic oxide before the blast gas leaves the top. Unless means are available for the utilization of this low grade gas for steam-raising or otherwise, there is a considerable loss of the heat value of the coal. Dellwik has proposed to work with a comparatively shallow bed of fuel which is more quickly raised to incandescence by the blast, while the reduction of carbonic acid to carbonic oxide is almost entirely avoided. By this means it is said that the consumption of fuel in blowing up is much reduced, while a greater amount of water gas is produced. The thermal efficiency of the intermittent producer worked on this principle is said to be 70 per cent. If these results are confirmed by a lengthened working experience, there ought to be a great future for the system.

In 1881, while engaged with Mr. William Young in developing our system of retorting oil shales, it occurred to us that the process we had evolved for that purpose ought to have a much wider field for development in the treatment of coal for the production of fuel gas and ammonia. Following our usual practice, we each set to work to realise our ideas in our own way. In September, 1883, I had the honour of laying the result of two years' experimenting in this matter before the Mining Institute of Scotland, and in the following April the general results of some 10 or 12 years' work on the nitrogen of bituminous minerals were laid before the Scottish Section of our own Society.* The paper read before the Mining Institute described certain experiments on a working scale which had been going on at Oakbank Works for two years on the gasification of coal in excess of steam alone or mixed with air. It also entered into the theoretical side of the thermal reactions involved in the process, and finally I permitted myself to indulge in certain sanguine forecasts of the far-reaching effects which would flow from the use of the process. The experiments showed that it was commercially possible to oxidise coal with a mixture of steam and air, to recover 90 to 120 lb. of sulphate of ammonia per ton, and to produce a fuel gas of which the following is an analysis:—

	Per Cent.
CO_2	16·6
CO	8·1
CH_4	2·3
H	28·6
N	44·4
	100·0

The thermal value of this gas is about 150 B.T.U. per cubic foot. The calculations showed that with proper recuperative arrangements a thermal efficiency of over 80 per cent. might be reached by this process. The unit plant at work was a small one, only capable of dealing with a few tons of coal per day. The increase of the retorting or gasifying plant, however, presented no difficulties; the real barrier to progress was the enormous volume of gas which had to be cooled and scrubbed efficiently and economically. It must be remembered that at that time the problem of dealing with 170,000 cubic feet of gas per ton of coal was practically a new one. Messrs. Alexander and MacCosh were just working out the recovery of tar and ammonia from the gases of the blast furnace, and their plant was on its trial. In no other industry had any serious attempt been made to deal with such enormous volumes of gas as were involved in the gasification of the whole of the carbon in the coal.

While we were considering ways and means by which this large volume of gas might be economically cooled and scrubbed, the price of sulphate of ammonia began to fall, and very soon reached a point at which the profits of our process, depending, as they did, so very much on the value of the ammonia recovered, began to appear problematical. Meanwhile the extensive adoption of our shale retorting system and the patent litigation to which it gave rise absorbed so much energy and attention that the fuel gas process was allowed to lie dormant till better times should arrive.

My distinguished predecessor, Dr. Ludwig Mond, in his address at the London Meeting of 1889, unfolded before the Society the successive steps by which he had developed this same process. But he was able to go further than we had gone. He had not stopped short of the construction of a complete plant fully equipped at every point for the burning of coal in excess of steam and air, and fully equipped also for the economical scrubbing and handling of the great volume of gas produced by the process. This work will be always regarded by those who are familiar with it as a monumental illustration of what is meant by chemical engineering in its proper sense. The gospel of cheap and plentiful ammonia and smokeless fuel, which it had been my privilege to announce to the Mining Institute of Scotland in 1883, was again sounded forth with the added weight of years and achievement by Dr. Mond in 1899, but I regret to say that it has not as yet met with any general acceptance.

To those of us who are intimately acquainted with the process and the gas it can produce, it is surprising to find how very slowly it has made its way in the industrial world. This may partly be explained by the reluctance of the British manufacturer to take up a complicated operation, however perfect it may be, if by any chance he can find anything simpler which will do only half as well!

I think we must now take it for granted that the best way to extend the use of fuel gas will be by the formation of fuel gas centres in suitable localities. If such centres were in a position to distribute not only fuel gas but also light and power at a moderate cost, and without the pollution of th air and general surroundings, one cannot help feeling that industry of all kinds would be drawn towards such desirable localities. Industrial cities of an ideal character would be created, for into such desirable surroundings it would be natural that the best skilled labour should tend to gather; surroundings where the conditions of life would be clean and bright, instead of gloomy and squalid.

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* See this Journal, 1884, 216; J. Soc. of Arts, Feb. 20, 1885; and Appendix, p. 665, for drawing of Young and Beilby's Gas Producer of 1883.

Since writing the foregoing it has been my privilege to visit the works of Messrs. Brunner, Mond, and Co., at Northwich, and to see the complete installation of Mond producers at work. My knowledge of the process and of its special points of difficulty enabled me to appreciate the great skill and courage which must have been devoted to its development in this plant; the skill in meeting the practical difficulties with which the problem bristled and the courage and breadth of mind with which so huge an undertaking has been grasped in its true proportions.*

From the careful selection of the most suitable slack, by a series of ingenious laboratory tests, to the final distribution of the fuel gas under uniform pressure over the extensive area covered by the works, the whole system is perfect and complete. Carefully devised checks and controls are to be found at every point, so that an intelligent technical manager can keep his hand on the process under all conditions.

After seeing this plant at work I was naturally led to further consider the question—Why has this process of gas production met with so little acceptance in the world of industry, chemical and metallurgical? The answer to this question appears to be at least threefold. In the first place, the process is a delicate one and the plant is complicated. It requires, therefore, to be superintended by a well-trained technical man, who can be depended upon to devote steady attention to keeping the whole system on the rails. A little carelessness or neglect might go a long way towards converting a safe and excellent process into a dangerous and extravagant one. In the second place, the first cost of the plant is so comparatively high that no one would care to take up the process except as an adjunct to some large manufacture of a very permanent character. In the third place, the price of ammonia, the by-product on which the commercial success of the process absolutely depends, has been subject to such violent fluctuations that manufacturers have naturally felt timid about incurring a heavy plant expenditure for the production of so fickle a commodity.

This last reason has already been dealt with in considering generally the effect of a largely increased production of sulphate ammonia on the market outlets and price. I will simply repeat what was then said, and I feel confident that such an increased production will tend to the establishment of a freer market and a steady, if moderate, price. With regard to the two other portions of the answer, these seem to lead up naturally to the policy of establishing fuel gas centres where the whole attention of the staff would be directed to the production and distribution of fuel gas to works in the neighbourhood. Whatever may be thought of schemes which involve the conveyance of fuel gas for really long distances, measured by tens of miles, there can be no doubt whatever that its economical conveyance to works within a mile or two of the producers is perfectly feasible. With a steady supply of the gas always available in the works' mains its value for furnaces of all kinds would soon become recognised and appreciated.

At the Engineering Conference recently held in London some doubts appeared to exist in the minds of those who took part in the discussion of Mr. Wm. Foulis' paper as to the real value of this particular fuel gas. These doubts may be set at rest in two ways: in the first place, a careful study of its composition will show that the high percentage of carbonic acid is more than compensated for by the high percentage of hydrogen. The result of this is to increase the temperature of combustion to a point very considerably above that of ordinary producer gas. In the second place, the results of practical experience fully confirm these theoretical conclusions. For a number of years I used a similar gas, the analysis of which has been given above, for the heating of a bench of shale-distilling retorts of the Young and Beilby type in which a temperature of 2,000° F. was easily maintained in the lower ovens, by the burning of the cold gas mixed with cold air. It would have been quite easy to preheat the gas and air if that had been necessary, but the temperature obtained without pre-heating was quite satisfactory. The extensive experience of Messrs. Brunner, Mond, and Co. in the use of this gas in their furnaces is of itself a sufficient guarantee of its suitability and value for all such purposes.

Though not strictly in place, I may refer here to the use of Mond gas in gas engines. The experience at Northwich has been conclusive as to the economy and efficiency of this method of power production. A large gas engine of over 300 h.p. has been run continuously for a period of 139 days, the gas being measured into it through a meter, the power being taken off as electric current, which was also carefully measured. The coal consumption, taking the full proportion charged into the gas producers, worked out to something less than 1 lb. of coal per horse-power per hour as delivered by the engine to the dynamo. Messrs. Brunner, Mond, and Co. are preparing to follow this matter up by putting down two gas engines of 500 h.p. each. It is evident that power produced in this way will rival in cheapness the best water power installations, with the advantage that it can be obtained in localities which are conveniently placed for the transport of raw materials and products.

It is rather a striking thought that the 5 million h.p. which is at present developed by steam boilers, with a consumption of 50 million tons of coal, might be developed by Mond producers and gas engines with a consumption of only 10 million tons!

In the Mond producer I think we have found the means of completing our picture of the smokeless fuel factory of the future. With this addition, the factory would be in a position to supply smokeless fuel for every purpose, domestic or industrial, while its own internal economy might be practically perfect.

It would be a most congenial task to dilate on this ideal fuel factory, but the limitations of your time and patience compel me to pass on.

Application of Remedies to the Production of Heat for Domestic Purposes.

Great efforts have been made by smoke prevention committees to encourage inventors to produce some form of fireplace in which raw coal may be smokelessly burned. After watching these efforts for years, I think we may fairly conclude that a universal grate which, in unskilled hands, will burn all sorts of coal smokelessly, is practically unattainable. We may therefore at once dismiss this class of remedies for domestic smoke. We are then tied down to the application in some practical way of the second class of remedies, namely, those which are founded on the production of smokeless fuel by the preliminary treatment of raw coal. We have seen that by such treatment it is possible to produce four varieties of smokeless fuel, three of which are more or less applicable to domestic purposes. These are gas, briquettes, and coke.

I have placed these in what appears to me to be their order of merit. In the matter of gas heating, we know that a great deal has been done by the gas companies to extend the use of gas for domestic stoves and fires. The education of the public in this matter has been chiefly in their hands and in those of the stove makers, and we cannot but admit that great progess has been made in this department. The gas companies have no doubt been specially influenced in this movement by the strong desire to secure a daylight consumption of gas which would more fully occupy their distributing plant, and which would thereby help to reduce the heavy oncost in that department. It has therefore been to their interest to encourage the use of gas for cooking rather than for general heating purposes. Makers of gas stoves and fires have also pushed their wares well under the notice of the public. But if any large part of the 35 million tons of raw coal burned for domestic purposes is to be replaced by gas heating, something very different from the quiet progress of the past 20 years must be contemplated.

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* See also Presidential Address of Dr. Ludwig Mond, F.R.S., this Journal, 1889, 505; and Humphrey, Proc. Inst. C.E., cxxix., 1896-97, Part III.; and for drawings of Mond Gas Producer, Appendix, pp. 666—668.

We are naturally led to inquire what are the reasons for this comparatively slow adoption of gas heating, for if it is a sufficiently good thing to justify the amount of success it has already attained, surely it ought to be able to attain a very much larger success. The first question which suggests itself in this inquiry is, are we certain that the householder is being offered the very thing he wants, or is it possible that it is only more easily satisfied householders who are content to accept, as a solution of the domestic problem, the average gas fire, placed in position by the average gasfitter, and supplied with average gas at 3*s.* per 1,000 cb. ft.?

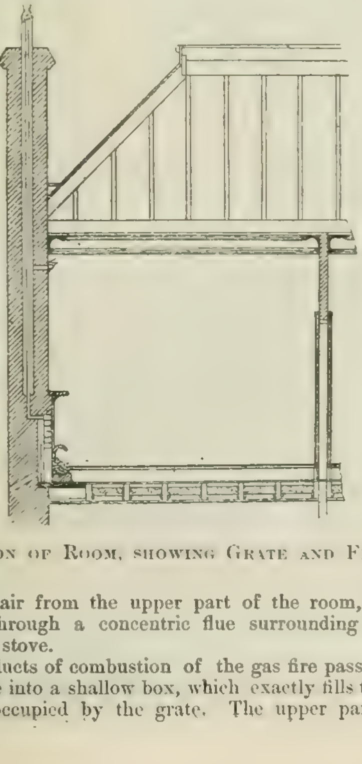
Some years ago I came to the conclusion that these three average items were combining to give domestic gas heating a rather indifferent reputation. At that time I tried to find out what were the desiderata for domestic gas heating, and how, if possible, these desiderata might be satisfied. These desiderata appear to be warmth and comfort, and ventilation at least equal to that obtainable from an ordinary coal fire, at a cost not too much in excess of that of the open fire. To satisfy the first two conditions, the gas must be burned in such a way as to deliver as much as possible of its heat as radiant heat which must primarily warm the objects in the lower part of the room, say, from the floor to six or seven feet above it. Convection currents will ensure that more than sufficient heat will be taken to the ceiling and upper parts of the room; therefore special effort must be directed to keeping the heat low down. The question of ventilation is absolutely vital, and must on no account be left to chance. Apart from the imperative necessity that the products of combustion of the gas, together with chance leakages of gas, should be removed from the room with certainty under all possible conditions of temperature and weather, health and comfort alike require that the atmosphere of the room should be continuously but imperceptibly changed. The first of these conditions involves the providing of a proper flue connection from the stove to the roof ridge of the house. The second or general ventilation requirement must be met by bringing in fresh air from the outside and removing the warmed and used-up air from the ceiling level of the room. By preference the fresh air ought to be delivered into the room at or near the temperature of the air of the lower part of the room. Let us try now to ascertain how far the average gas fire and the average gasfitter can be depended on to meet these desiderata. The gas fire, as it is now manufactured, is a very fair machine for the conversion of gas into radiant heat of high temperature. A fuller appreciation on the part of the makers of the desirability of the delivery of the maximum amount of heat in the radiant form might lead to further improvements in the concentration of the heat of combustion in the zone of incandescence and the avoidance of the loss of low grade heat by the freer use of non-conductors, and by careful adjustment of dimensions. The chief fault to be found in the domestic gas firing of to-day is with the haphazard way in which the fire or stove is pitchforked into surroundings, which are badly adapted for its reception. Fortunately, even the average gasfitter recognises that the products of combustion must be removed from the room, so that a flue or chimney of some sort is always provided. But this chimney is almost invariably the vent of an ordinary open fireplace, which is much too large for a gas fire, and which may be subject to fits of down-blow. A blow-down with a gas fire may not be so dirty and disagreeable as with an open coal fire, but it is probably much more dangerous to health, just because it may go on to a very serious extent without being noticed. We may take it as fundamental that, if domestic gas firing is to be satisfactory, the most perfect provision must be made for the uninterrupted removal of the products of combustion under all conditions of wind and weather. One of the stock arguments in favour of the open coal fire is that its presence in the room secures a certain amount of natural ventilation. For long no one ventured to criticise the claim, but recently it has been whispered among those who have most closely studied ventilation that this claim is not quite unquestionable. That an open fire with a good chimney draught does drag a great deal of cold air across the room on the floor level and hurry it up the chimney we none of us doubt—our feet are sufficiently good thermometers to tell us that. But that this is satisfactory ventilation may be doubted, seeing that it leaves untouched the warmed and exhausted air which lodges in the upper part of the room.

Gas fires are adapted to the ordinary open fireplace in one of two ways. Either the flue pipe is carried into the fireplace with a right-angled bend to direct the flue gases up the chimney, or the chimney is closed by a plate through which the flue pipe is led. In the former case, as the chimney is left open there is still the same up-rush of air as with a coal fire. In the latter case only so much air as can pass through the small flue pipe is taken up the chimney. In neither case will the action of the chimney be more efficient than with the open fire, and if there is a tendency to down-blow the risks will remain as before.

I have found, by experiment, that the products of combustion from a gas fire burning 30 cb. ft. of gas per hour can be removed by a stove pipe of from 2 ins. to 3 ins. in diameter, according to the length of the pipe and the bends necessary. It is therefore evident that the ordinary 10-in. chimney of the open fire is from 10 to 20 times too large, so that the velocity of the up current of gas in such a chimney is from 10 to 20 times slower than it need be. One of the first results of reducing the diameter of the chimney, and thereby increasing the velocity of the flue gases by 10 to 20 times, is to abolish all risk of down-blow; no small advantage when gas is to be burned in bedrooms.

But when the flue pipe and chimney are so far reduced it will be found that the temperature of the products of combustion, as they are dismissed from the gas fire, is far in excess of what is necessary to maintain a sufficient current. Therefore we are at once put in possession of a certain amount of heat which is available for other purposes. When gas is burned in a gas fire with a moderate excess of air, one-fourth to one-third of the total heat of combustion escapes with the product of combustion. With so expensive a fuel as gas this is a serious item.

In designing the arrangement of the gas fire, which is illustrated in the diagram before you, I have attempted to utilise this heat, partly as direct radiation into the room, and partly for raising the temperature of an incoming current by fresh air. This fresh air takes the place of the hot and exhausted air from the upper part of the room, which is removed through a concentric flue surrounding the flue pipe of the stove.

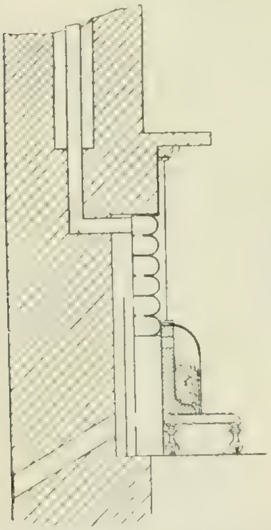


Section of Room, showing Grate and Flue.

The products of combustion of the gas fire pass through a short flue into a shallow box, which exactly fills the space formerly occupied by the grate. The upper part of this box is filled with partitions which cause the flue gases to follow a zigzag course on their way to the flue pipe, which starts from the upper side of the box and passes up the inside of the old chimney. The flue pipe, which is of strong sheet zinc and is about 3 ins. in diameter, is led up to the top of the chimney case. The old chimney is closed round the lower part of the flue pipe, and its upper end is used as a ventilating shaft for the room, an opening being made into it at the ceiling level.

A fresh-air inlet is made at the back of the fireplace, the air from which passes over the back of the shallow box and enters the room through openings on either side of the gas fire. These openings are tubed across the shallow box, so that the fresh air does not enter the box, but passes across it into the room. When the fire is burning, the front of the shallow box is kept hot by the flue gases, and radiates a considerable amount of heat into the room. The flue gases, as they pass from the box, still contain sufficient sensible heat to ensure a vigorous draught up the small flue pipe, and and also to maintain a ventilating current in the annular flue.

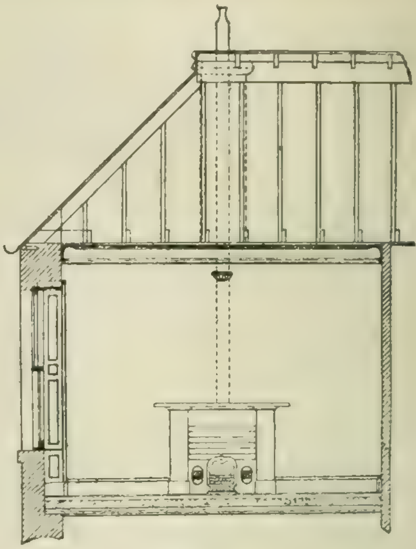
These designs are not patented or protected in any way, and I shall be only too glad if their publication contributes in any way to an improvement in the efficiency and economy of domestic gas fires.



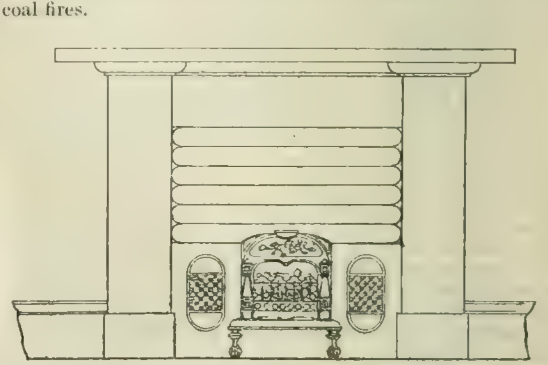
Enlarged Section of Grate, showing Ventilation System.

Though some of the details of this arrangement have been only recently evolved, the more important features have been in use now for a considerable time, and the experience of the arrangement has clearly indicated that the leading principles are sound. The small flue and chimney have been an absolute cure for down-blow in the case of one chimney which had been a very grave offender when it was worked with an open coal fire. The recovery of a large part of the formerly waste heat of the flue gases has made a very marked economy in the gas consumption, while the provision for the warming of the room from the floor upwards has added considerably to the comfort attained by the system, especially when used for bedroom warming. During the coldest nights of the past winter a comfortable temperature was steadily maintained in a room with outside walls facing N.W. and N.E., and containing 2,700 cubic feet of air, by a consumption of gas of from 10 to 15 cubic feet per hour.

While there is no immediate prospect of any considerable reduction in the price of illuminating gas, yet, as the larger changes in the destructive distillation of coal, which we have been considering, come about, it will be possible to deliver gas to the private consumer at a considerably lower cost than at present. It is not sufficiently recognised that, of the three principal items which make up the cost of gas to the consumer, namely, the manufacturing cost, the distributing cost, and capital charges, the two latter are by far the heavier. Coal gas could be delivered into the gasholder at 10*d.* to 12*d.* per 1,000 cubic feet, and at half that price, if unenriched coke-oven gas were supplied; but distribution and capital charges add from 18*d.* to 30*d.*, bringing up the total from 2*s.* to 3*s.* 6*d.* per 1,000 cubic feet. If gas for domestic heating were to replace any considerable part of the 35 million tons of coal at present used for that purpose, the mere increase of output at the gas works would very considerably modify these items of cost, and I am hopeful that the town consumer may yet get a thoroughly satisfactory gas at from 1*s.* 6*d.* to 2*s.* per 1,000 cubic feet. At such prices gas heating would compare favourably in cost with coal fires.



Section of Room, showing Grate in Elevation.



Enlarged Elevation of Grate, showing Air Inlets and Heat Radiator.

There is no doubt that the extension of domestic gas firing would be more rapid, as well as more satisfactory, if the architect and builder were to co-operate with the gas engineer, so that new houses may be deliberately planned and prepared for gas firing by the introduction of proper chimney and ventilating arrangements. If good models of such installations were to be seen at work in every large town, the education of the average householder would proceed on much more satisfactory lines. The more intelligent householders must be satisfied in some practical way that their rooms can be warmed and ventilated more satisfactorily by gas than by coal fires. They must, further, be satisfied as to the real cost of gas heating, so that they may be in a position to judge under what conditions the advantages of gas will compensate for its extra cost. I can imagine no better opportunity for the fitting up of well designed and executed installations than is afforded by the modern development of the flat system in London. How far gas heating may have been adopted in any of these mansions I do not know, but if a perfect system were evolved by the architect and the scientific gas engineer working in concert, the convenience and comfort of the system would be so appreciated that it would speedily become universally adopted in such mansions, and we may be certain that from these it would spread to clubs, boarding houses, hotels, and private houses and offices.

The general principle which we have adopted in dealing with our subject, namely, that we must try to grasp the true relations and proportions of each and every department of it, compel us to recognise that the replacement of 35 million tons of raw coal by gas for domestic heating, even if it were most desirable, could only be very slowly accomplished. Nor must we forget that the distillation of this coal would leave us with 60 to 70 per cent. of its weight in the form of coke, the disposal of which must be duly provided for. It is well known that coke as such is not a favourite fuel for domestic purposes. Therefore it is unlikely that any large proportion of an increased production of coke would be disposed of as fuel for private houses.

This difficulty brings us round again to the consideration of fuel briquettes as an outlet for the by-products, coke and pitch, and as a means of supplying a clean, convenient, and comparatively smokeless domestic fuel. While the ordinary householder accepts raw coal as a necessary evil, only the favoured few who can afford to burn the most expensive qualities of house coal can count upon obtaining a uniform and satisfactory article. The coal merchant, like the wine merchant, keeps a very imposing array of well-known names on his list. But the consumer soon learns that it is one thing to have a well-known name on the list, but quite another to have the actual product it represents in his cellar! The coal we most of us burn is certainly a very crude and uncertain form of fuel. While there may be economy in burning such crude fuels in situations which are near the pits, and where railway carriage is not an important part of the cost, such economy is bound to disappear whenever a long railway carriage is involved, and in these cases it would be actually cheaper to carry a clean fuel than a dirty one.

I believe that the fuel briquette has very great possibilities before it as a domestic fuel. The materials at the disposal of the briquette maker, together with the power he has to vary the size, shape, and texture of the briquettes, should enable him to adapt his product to meet the requirements of the householder. The manufacturer who will take the trouble to go carefully into this matter may rest assured that he will find intelligent consumers ready to absorb his output. But it must be the manufacturer's first business to find out exactly what the consumer wants. The consumer does not always know this himself, but he does know quite unerringly when the thing supplied to him is *not* what he wants, and no amount of persuasion will lead him to accept the imperfect substitute. The warming of our houses is too intimately associated with our sense of comfort ever to remain for long at the mercy of fad or fashion. We may be satisfied to provide the friends who visit us with picturesque but unrestful chairs because our upholsterer persuades us hat they are fashionable or artistic, but we invariably settle nto a comfortable, if unfashionable, lounge for our own hours of ease. I think fuel and fires come sufficiently close o our real selves to be out of the reach of mere affectation, so that any changes in these must be genuine improvements f they are to be acceptable. Whenever a really improved uel is presented to the householder we may feel pretty sure he will gladly accept it. Carlyle's unflattering remark about the majority of his fellow-countrymen does not apply o them in relation to the solid comforts of life. If gas ires and fuel briquettes have not hitherto met with general acceptance, I suspect we must admit that it has been the producers, not the consumers, who have been lacking in wisdom.

Having travelled over the whole subject of fuel and smoke s exhaustively as is possible within the narrow limits of a ingle hour, let me very briefly gather together the chief propositions with which we have dealt.

We have found that the questions of fuel and smoke are o intimately bound up together that the magnitude of the rst is practically the measure of the second. By an analysis f the coal consumption of this country we have arrived at a fairly accurate idea of the relative importance of the various sources of smoke pollution. Still preserving a proper sense of proportion, we have seen that the large quantity of coal which is consumed for the production of power might, by merely mechanical means, be consumed practically smokelessly. By the study of that portion of the coal consumed which is at present being separated into volatile and non-volatile substances by destructive distillation, we have been enabled to estimate the probable effects which would follow if destructive distillation were applied as a preliminary treatment to any large proportion of the coal which is at present burned in the raw state. The possible smokeless fuels of the future have been passed in review—coke oven gas, retort gas, producer gas, oil, coke, and fuel briquettes; and we have seen the importance of simultaneously developing the use of these side by side, so that a due balance may be preserved among all of the products of distillation. The application of these forms of smokeless fuel to the various industrial and domestic purposes has been considered, and we have seen that, in most cases, there are substantial advantages to be derived by the judicious use of these forms of fuel, altogether apart from the abolition of smoke.

Knowing now that the means are in our own hands by which, practically, the whole of the coal consumed might be burned without offensive smoke, it seems natural to inquire by what means, if any, the adoption of these remedies might be hastened. The answer to this, so far as it appears to me, is—Arouse the self-interest of the consumer, and at the same time try to educate his public spirit. As a stimulus I think that a little coercion, gently and discriminately applied, would be invaluable. By this I do not mean fitful and ill-judged prosecution under the Public Health Acts. What is in my mind is rather the establishment of a department of the Government, with a man of skill and tact at its head, who would have the sole power of judging when to prosecute and how to adjust the standards to the requirements of each industry and district. The extraordinary success of the Alkali Acts, under the tactful administration of the three able men who have successively been responsible for their administration for the past 36 years, affords a distinct encouragement to the authorities to deal with the smoke difficulty on somewhat similar lines.

One thing is certain, there can be no feeling of fairness and justice in the minds of manufacturers while, as at present, there is practically a different administration of the law for each district. Rural and urban manufacturers must be judged by the same standards, so far as these are applicable to the several industries. To take a flagrant example of this inequality, while the Glasgow municipal authorities are seriously striving to control smoke production, manufacturers in certain districts outside the city continue to pour forth volumes of black smoke, unabashed and unchecked. The result of this is, that when the wind is in certain directions Glasgow is smothered in smoke which is not of its own making, and which the city authorities are powerless to check. This condition, no doubt, holds equally in many other industrial centres.

The different improvements in the use of fuel must continue to be worked out by specialists, who can give undivided attention to their own particular departments. But if I have at all made out the proposition with which I started, namely, that the time has arrived when the questions of fuel and smoke may, with advantage, be treated on a broad plan, and with their several parts in due proportion, then it must be admitted that the best progress can only be ensured by the co-operation of the leaders in all the various departments concerned. Engineers, chemists, metallurgists, gas engineers, and architects, along with coalmasters and manufacturers, ought to have their common interest aroused, in order that they may unite in applying the best knowledge of each for the good of all.

In concluding, may I suggest that, as a means of bringing all the different interests which are concerned in this matter into line, our Society might arrange for the holding of a conference on the subject of fuel and smoke, at which the leading technical societies as well as the actual industries concerned should be fully represented?

NOTE.—For drawings, see pp. 664—668.

THANKS TO THE PRESIDENT.

Mr. **DAVID HOWARD** rose to propose a vote of thanks to the President for his address. He said: I will ask you to join me in thanking our retiring President most heartily, not merely for justifying his presence in the Presidential chair, by the magnificent address which he has given to us, but justifying the very existence of our society. It is for the study of such questions as these that the Society was founded, and never have we heard a more important question treated more ably than this has been. How can we over-estimate the importance of this question? The waste of fuel is simply amazing. One sometimes begins to think has one's decimal point gone wrong? when one considers the proportion of result to the proportion of coal burnt. Undoubtedly we must face the disappoval of the coal merchant when we are dealing with this subject. How far the subject can be dealt with as a whole is a matter to be considered most carefully. In the meantime, let us deal with it in particular, every one of us. Have none of us egg-ended boilers? Have none of us a variety of other arrangements which were very respectable when they were put up, perhaps in the very forefront of progress, but which would now be better relegated to a museum of dangerous antiquities? This question touches every one of us, and it will touch our successors more. And, may I say, amid all the complaints of rivalry from abroad, there are few things where the difference is greater between English manufacturers and their German rivals than in the scientific application of skill to the saving of coal. Our coal bills are founded on slack at 2*s*. 6*d*. per ton. The Germans have never had that misfortune of cheap fuel. Let us try to recover from the misfortune of having had cheap fuel before it is too late. I ask you to join me in a most hearty vote of thanks to our retiring President, for his admirable conduct of the Society during the past year, and for his admirable address.

Mr. **JOHN PATTINSON**: I have pleasure in seconding the resolution which Mr. Howard has so ably put before you. Mr. Beilby, by his eminent work in connection with the industry of paraffin oil manufacture, with which he is most intimately connected, and especially with the utilisation of the nitrogen of shale and coal, and also for the admirable work he has done in the Scotch Section of our Society, was indicated as a suitable occupant of the Presidential Chair. The manner in which he has carried out the duties, and also the admirable address which we have listened to this morning, amply confirm the judgment of the Society in appointing him to the office. He has dealt this morning with one of the most important questions that can possibly be dealt with by any society. In the use of coal smoke, I am afraid our visitors will say that Newcastle has not profited very much yet by the many appliances for the prevention of smoke. But the fact is, that, without the co-operation of the stoker, it is impossible, I think, to prevent entirely, or to a great extent, the emission of black smoke. The gentle coercion to which our President has alluded would be very well applied, I think, in this case, if we wish to stop the terrible nuisance of smoke in our cities. I have great pleasure in seconding the resolution.

The motion was cordially agreed to.

The **PRESIDENT**: I can only again thank you most heartily for your kindness to me on this occasion. I entered with considerable diffidence on the duties of the Presidency a year ago, and it was only in the belief, then, that I should have the co-operation of my good friends in the Council that I agreed to take it up. That belief and that confidence have been more than justified. The kindness and help which I have received have been simply enormous; and the work which has been done for the Society during the past year could not possibly have been done except by a capable and willing Council, and by local committees who have done everything they could for the Society, and who have made it easy for me to carry through the duties of the Presidentship during the past year. I thank you most heartily.

THE APPOINTMENT OF AUDITORS.

Mr. **THOMAS TYRER** proposed that Messrs. Miall, Wilkins, Randall & Co. be the auditors to the Society for the coming year, at a fee of 10*l*. 10*s*.

Dr. **G. SCHACK-SOMMER** having seconded the motion, it was adopted.

THE IMPERIAL INSTITUTE.

Mr. **WALTER F. REID** said: In the loss of our Treasurer, Mr. Rider Cook, several gaps have been made in our ranks. We miss his genial presence from the Council; and, though we have an able successor in Mr. Hall, there is still one vacancy remaining, and that is, our representation upon the Imperial Institute. The Imperial Institute has not, up to the present, perhaps, fulfilled all the expectations which were aroused when it was created; but times are changing. Partly from the pressure of nations around, partly, let us hope, from increasing affection, our colonies are drawing day by day closer to us; and we have in the Imperial Institute a focus in which much useful work might be done, not only politically but technically. We ought, therefore, to send a representative to the Imperial Institute who will be able to represent us technically, and to represent us well. I know no man in our Society who is better able to do that than our President, Mr. Beilby. You have all listened with perfect attention and interest to the very exhaustive paper which he has read to us. Mr. Beilby has gone into these questions with very careful attention and detail. For instance, he has gone into the question of chemical engineering, and he could tell us, perhaps, more about the manufacture of cyanides than anybody here. There are other subjects, also, in which he is equally well versed. Therefore I think we could have no better representative on the Council of the Imperial Institute than the President. It is important, too, that we should be sure of his active co-operation with Prof. Chandler during the present year.

Mr. **OSCAR GUTTMANN** seconded the proposition. He said: My friend, Mr. Reid, who has made the nomination, was nominated to go with our President as representative on the National Physical Laboratory. You will see from this that the Council desires to give to our President a wider field of activity than he has hitherto had. He has worked on the Council with great diligence; and in his address to-day he has given us what may be called the domestic side of his activity. If we elect him as our representative on the Council of the Imperial Institute, we will give him greater scope and a wider field for his work, in which we all believe he will be successful.

The motion was adopted.

The **PRESIDENT**: I thank you for this kind and complimentary appointment.

THANKS TO THE COLLEGE AUTHORITIES.

The **PRESIDENT** said one of the features of their Society was its peripatetic qualities. They moved about from one place to another, from year to year, and that brought with it the necessity of finding temporary quarters. They were always hospitably received in the towns which they visited, and on this occasion they were indebted to the Council of the Durham College of Science. He could not imagine a more perfect place for the purpose of such a meeting as that, than that beautiful room. He thought they would readily accord a most hearty vote of thanks to the Council of the Durham College of Science for so kindly granting to them the use of that Chemical Theatre and also the other College buildings during their visit.

Mr. **F. STIRLING NEWALL** seconded the motion. He said they would do very badly in Newcastle without those buildings, not only as a centre of learning, but also as a place of meeting. The Council was always most kind in lending the rooms for any purpose which was for the advance of learning and science.

The motion was carried.

The meeting then ended.

VISITS TO WORKS AND PLACES OF LOCAL INTEREST.

After the morning's business and on the invitation of the Reception Committee, lunch was provided by the Section in the Grand Assembly Rooms.

THE MAYORAL GARDEN PARTY IN LEAZES PARK.

On arrival in the afternoon after lunch, the party of members, with their ladies and friends, was cordially received by the Mayor and Mayoress of Newcastle (George

Harkus, Esq., and Mrs. Harkus), and, in spite of intermittent showers of rain, a large attendance of guests was secured. Although the atmospheric conditions were somewhat depressing outside, ample compensation was offered by the sight of the marquée erected in the grounds; and inside and under cover, conversation, music, and refreshment were enjoyed without let or hindrance. Among the guests present were the Mayors and Mayoresses of Gateshead, Jarrow, South Shields, Durham, and Stockton, and Mr. W. Watson Armstrong, High Sheriff of Northumberland. The acceptances to the invitations given, numbered over 2,200.

Reception and Conversazione at the Natural History Society's Museum.

Conversazione.

In the evening the members, with a large number of other guests, were entertained by Mr. F. Stirling Newall, Chairman of the Newcastle Section, a reception and conversazione being held in the Natural History Society's Museum at Barras Bridge. Music was provided, and also light refreshments during the evening. The guests were at liberty to inspect the splendidly mounted and unique collection of birds and animals, and the fine geological collection, in which the remains of the vertebra of a gigantic ichthyosaurus attracted special attention.

SECOND DAY.—Thursday, July 13th.

The River Excursion A.

The steamer "Siren" called at the Fish Quay, between the High Level and Swing Bridges, at 9.30 a.m., and after taking on board about 100 members, among whom were the President, with Mrs. and Miss Beilby, proceeded up the river as far as Redheugh Bridge. On its return, in going down the river, the vessel had to pass the large swing bridge, which, by the courtesy of the River Tyne Commissioners, was opened for this purpose, as well as that of exhibiting its action. On the way seawards the party called at the works of the Wallsend Slipway and Engineering Company. After an inspection of these works, to be hereafter described, the journey was resumed, and the "Siren" steamed out to sea in dull but calm weather. She brought up off Whitley, and the visitors were there given a fine view of the speed performances of the Hon. C. A. Parsons' now famous "Turbinia," which were watched with interest and astonishment. This remarkable model steamer, fitted with Parsons' steam turbines, rushes partly through and partly over the water, at the rate of about 45 miles per hour, and is doubtless designed to show what Mr. Parsons is prepared to do in the way of torpedo-boat destroyers, if orders be given him. When steaming along at full speed by night, and vomiting flame from its short funnel, the "Turbinia" must indeed present both a strange and terrible appearance.

Subsequently, luncheon was served on board the "Siren," after which a portion of the company, including most of the ladies, on arrival at Tynemouth pier, disembarked, and came back to Newcastle by train. The remainder returned by the "Siren," breaking their up-river journey by a visit to Messrs. C. S. Swan and Hunter's shipbuilding yard at Wallsend.

They also visited the "Ermach," a Russian ice-breaking ship, which was in dry dock for the purpose of having her bows strengthened, preparatory to a voyage to the Kara Sea. Designed by Admiral Makaroff, and constructed by Messrs. Armstrong, this vessel has a bow, the keel of which is higher than the main keel, and underneath it revolves a screw to withdraw water from underneath the ice, whilst the keel of the bow rests upon and breaks down the ice. Captain Vasilikoff kindly explained these details for the benefit of the members.

EXCURSION A (i.)

The Shipbuilding and Dockbuilding Yards of C. S. Swan and Hunter, Limited.

Here the company was divided into parties, which were placed under the care of Mr. G. B. Hunter and his colleagues and managers. The members were then shown the various processes involved in the construction of a modern iron steamship, the Cunard liner "Ivernia," in course of construction, being the principal example before the visitors. One of the first large passenger vessels built by this firm was the "Courier," launched in 1887, she being 221 ft. long between perpendiculars, 30 ft. by 13 ft. 3 ins., with single screw, and having what was then the high speed of 17½ knots. The large merchant vessels here built are entirely constructed under cover in gigantic ship sheds covered with glass. These sheds are 500 ft. in length, one of them being 68 ft. wide, and the other 71 ft. 6 ins., the inside height of both being 83 ft. Each shed is provided with two electric travelling cranes, with revolving jibs working below the cranes, and capable of lifting a weight of 3 tons, and of travelling at the rate of 300 ft. a minute.

After the inspection by the visitors, afternoon tea and light refreshments were kindly provided. A vote of thanks to the firm for the demonstration and entertainment was then proposed by the President, Mr. Beilby, and seconded by Mr. David Howard. It was responded to and acknowledged by Mr. G. B. Hunter for the firm.

EXCURSION A. (ii.)

The Wallsend Slipway and Engineering Co., Ltd.

This establishment comprises two separate departments:—

The repairing department, which deals with the repairing of ships and their engines and boilers;

The engineering department, which deals with the construction of engines and boilers.

The chief features of the repairing department are two slipways, each 1,000 ft. long, and a large graving dock.

The slipways were laid down in 1873, when the works were started purely as a repairing establishment, and since their opening, 2,295 ships have been dealt with on them.

After the cradles have been run down and the ships placed thereon, they are hauled up out of the water by hydraulic power.

Owing to the sizes of ships increasing beyond the capabilities of the slipways, it was found necessary to provide further accommodation, and this took the form of a large graving dock, 540 ft. long by 88 ft. wide, with a depth of 25 ft. of water on the Cill at high water. This graving dock was opened in January 1895.

By means of large centrifugal pumps it can be emptied in from 1 to 1½ hours.

The dock is also fitted with a complete installation of capstans, &c. for placing ships in position; and for working on board oil steamers, where no naked lights are allowed, there is provided a complete system of electric lamps, &c.

In connection with this department, there is also a large shed for preparing the plates and ironwork required for the various repairs to the hulls of ships.

Since the dock was opened in 1895, the Company have docked and repaired several of the large Atlantic liners.

The engineering department occupies by far the greater portion of the Company's property.

Beginning at the bottom of the yard, the first thing that strikes one is the large sheer legs, which are required for lifting the boilers and engines on board ship. These sheer legs are capable of lifting 80 tons, and yet are often tested to their utmost capacity to deal with the large engines and boilers the Company are turning out.

The Company have turned out no fewer than 880 boilers, weighing over 30,000 tons, since commencing to act as boiler-makers.

In the machine shop were seen the different pieces of machinery being finally prepared, before taking their respective places in the erection of a marine engine.

For the handling of the work there are four large overhead travelling cranes, besides many smaller jib cranes.

Leading out of this shop is the erecting shop, 210 ft. long and 55 ft. wide, which has been quite recently put up, and is said to be one of the finest of its kind.

To facilitate the course of erection, there are two powerful overhead electric cranes and two hydraulic jib cranes on one side of the shop, together with other numerous appliances.

There were being erected in this shop a set of large twin-screw quadruple expansion engines for a steamer for the Cunard Company, and three other sets of smaller engines.

The Wallsend Company have turned out 320 sets of engines of over 420,000 h.p., comprising an almost endless variety for the propulsion of different types of vessels. Among the more notable engines are those for the Russian icebreaker, "Ermack," the Finnish icebreaker, "Sampo," R.M.S. "Orient," S.S. "America Maru," R.M.S. "Aorangi," &c.

They also built the first triple expansion engines made on the Tyne, these being fitted into the S.S. "Isle of Dursey" in August 1898.

At the present time in both departments, employment is found for over 2,000 men.

EXCURSION B.

The Whitburn Colliery of the Harton Coal Company, Limited.

This colliery is the property of the Harton Coal Company, Limited, who are also the owners of the Harton, Savit Wilda, and Boldon Collieries; it is situated near to the coast, about midway between Sunderland and South Shields.

There are two shafts; the downcast (No. 1) being 12 ft. diameter; it is sunk to the Brockwell seam, which is about 114 fathoms below the surface. From the Brockwell seam a drift has been driven through a dip trouble of 33 fathoms, which wins the Bensham coal on the south side of the shaft.

The upcast shaft (No. 2) is 13 ft. in diameter, and is sunk only to the Bensham seam, which is about 115 fathoms from the surface.

When commenced, both these shafts had a diameter of 16 ft., but as the ordinary method of sinking had to be discontinued (owing to the great influx of water) and the Kind-Chaudron system employed, the shafts were reduced to their present size.

At one time during the sinking of the shafts, the undermentioned pumping plant was employed:—

No. of Engines.	Cylinders.		Sets of Pumps.		
	No.	Diameter	No.	Diameter.	Stroke.
		Ins.		Ins.	Ins.
1	2	48	2	30	72
1	2	44	3	20	60
1	2	26			

The largest quantity of water pumped was 12,000 gallons per minute, this being the greatest quantity of water pumped at any winning in the north of England. Ultimately the volume of water became so great as to necessitate the introduction of the Kind-Chaudron system of sinking, and eventually the shafts were successfully sunk through the water-bearing strata by this system, the water being tubbed off.

The only seam at present working is the Bensham seam; the output from No. 1 shaft being about 1,100 tons per day, and from No. 2 shaft about 1,500 tons per day.

The colliery is ventilated by means of a Walker fan, 24 ft. in diameter by 8 ft. wide, driven by a compound horizontal engine. With the engine running at 41 revolutions per minute, and the fan at 91 revolutions, 256,000 cb. ft. of air are supplied at a water gauge of 3 ins.

The whole of the surface erections and buildings are lighted by electricity, the plant consisting of—

One dynamo for 1,000 lights.

One spare dynamo for 400 lights.

These are driven by a Robey engine, with a cylinder $19\frac{1}{2}$ ins. in diameter by 40 ins. stroke, fitted with automatic expansion gear and trip valves, and working at 82 revolutions per minute. Both the dynamos were built by Messrs. E. Scott and Mountain, Ltd., of Newcastle-on-Tyne.

It is proposed to further extend this plant by carrying cables down the shaft and lighting the shaft bottoms, sidings, stables, &c.

The whole of the water is pumped from the face of the dip districts to the standage at the No. 1 shaft by means of special and small Cameron pumps worked by compressed air. The water is pumped from thence to bank (a vertical height of 1,100 ft.) by one of Tangye's three-throw duplex pumps with pair cylinder, each 20 ins. diameter, and rams $4\frac{3}{4}$ ins. diameter.

The engines driving the belt screens are of Tangye's single horizontal type, with cylinders 18 ins. in diameter by 36 ins. stroke, working at 68 revolutions per minute.

There are at present at work 15 double-flued Lancashire boilers, 8 ft. diameter by 30 ft. long; two marine type of boilers and five cylindrical boilers. These latter boilers are gradually being replaced by Lancashire boilers 8 ft. diameter by 30 ft. long.

Gravitation roads are being made on the surface for a double heapstead for the conducting of tubs from the shaft mouth to the tipplers leading to the screens, the empty tubs afterwards gravitating back to the cage; and a similar arrangement is being made at the bottom of the shaft.

There are four main jigging screens, each capable of making four descriptions of coal (best, nuts, peas, and duff). There is also a nut coal jigging screen. The jigging screens consist of six belts (formed of steel plates, each 70 ft. long by 5 ft. to 6 ins. wide, with middle partition for refuse and splints 9 ins. wide. Four of these belts are for the best coal, which is turned over the jiggers as they receive it from the revolving tippers, as it comes from the pit. The other two belts are for nuts coal, which is carried from the jiggers by cross belts to elevators, where it is jigged a second time to remove all smalls. The "smalls" are then carried back by another cross belt to a waggon for small coal. The nuts are passed on to the top 70 ft. belts above named, and are cleaned in the same way as the best coal.

B. (i.) Marsden Limestone Quarries and Limeworks.

Limestone is at present being extensively worked from three quarries, the stone being used by chemical and ironworks, and also for building purposes.

The stone belongs to the Permian formation, and is a carbonate of lime, remarkable for its freedom from impurities. One of the quarries produces stone eminently suitable for building purposes where great strength and durability are necessary.

Building Stone.—This stone can be obtained in large blocks up to 10 tons in weight, and from its hardness and durability is especially adapted for piers, quay walls, docks, bridges, and other heavy work. It is also very suitable for copings, flags, kerbs, channels, paving sets, steps, heads, sills, pillars, gate posts, and other purposes, and machinery has been erected for preparing this stone.

Chemical Limestone.—This is an exceptionally pure stone, containing 98 per cent. of carbonate of lime, is especially suitable for chemical purposes, for which it has a large sale.

Blast Furnace Limestone.—There is a large sale for this stone, as a flux in iron smelting, it being well adapted for the purpose.

Magnesian Marl.—Is used for chemical purposes, and for the basic lining of the converters in the Thomas-Gilchrist process of steel manufacture. It is also used as a binding material for macadamized roads.

Lime.—The lime made from the above stone, from its purity, is well adapted for plastering and building purposes. It is also extensively used for chemical purposes, and is burnt to contain only 1 per cent. of carbonic acid.

The quantity of stone worked exceeds 100,000 tons per year.

Lighthouse Quarry.—At this quarry, which is situated near to the Souter Point Lighthouse, the "face" is about 233 yards in extent.

Marsden Quarry.—At this quarry, in addition to the ordinary limestone, a very good bed of stone suitable for use in buildings, &c. is met with, stone of this nature being very rarely found in limestone quarries. Stone-dressing machinery, saws, &c. are at work in this quarry. The "face" is about 517 yards in extent.

The Harbour Quarry.—Limestone of an especially good quality is being worked here, and it is proposed to construct a harbour with breakwaters, &c., to be used for the shipping of coals, limestone, &c., as soon as sufficient excavation has been made. The "face" at this quarry measures about 333 yards.

Limeworks.—Six kilns are erected here, about 12,000 tons of lime per year being made for various purposes. Four qualities of lime are made, quicklime for use at chemical works, plaster and clot lime being used by builders, and small lime, in addition to being used by builders, is also used for agricultural purposes.

[C.—Durham Coke and By-Products Company, Lanchester.

For this excursion the train left the Central Station, Newcastle, at 8.40 a.m. On arrival at Lanchester, the visitors were shown the Simon-Carvés coke ovens in operation, and the process was explained to them. Mr. Henry Simon, C.E., of Manchester, was the first to introduce into England the improved Carvés or Simon-Carvés coke oven, a closed coke oven, with complete apparatus for condensing tar and ammonia, and for the collection of gas, previously treated for the recovery from it of benzol, the gas being returned to the ovens, after being raised in temperature or "recuperated," by contact with the highly-heated flues carrying off the crude by-products. This gas is then burnt as fuel under the bottoms and in the side-flues of the ovens, and thus serves to coke fresh quantities of coal. It is true that coke ovens have been devised before and tried in England, for coking coal and recovering by-products, but, before the advent of the Simon-Carvés ovens, none were sufficiently well adapted for the recovery of the right kind of by-products, *viz.*, those of distinct benzenoid character. (See this Journal, 1883, 403—404, and 1884, 601—606.)

The Company kindly provided the visitors with light refreshments.

D. (i.)—Elswick Ordnance Works.

Availing themselves of the kind invitation of the directors, a large party of members visited the Elswick Works of Armstrong, Whitworth, and Co., Ltd. On arrival, the visitors proceeded to make a tour of the ordnance works. The processes through which guns pass before they finally reach the stage of completion were inspected with deep interest, and also the blasting and moulding operations, carried on, as they are, on so gigantic a scale, and yet with such expedition. The party spent over two hours in inspecting the works.

D. (ii.) The Aerated Water Works of the Newcastle Breweries, Ltd.

The party of visitors was met by Mr. W. A. Bevan (Chairman of the Company), Mr. T. W. Lovibond (Managing Director), with Messrs. Barras Reed, J. L. Lovibond, Chas. Liddell, S. E. Watts, and R. C. Nelson, with Mr. Oswald (architect). The premises were then inspected, the new and much-improved machinery, which has been recently acquired, offering special interest. The party saw in operation the machines which refil bottles and recork at the rate of 65 per hour.

The new building has been erected on the site of the old Haymarket Brewery, which belonged to Messrs. Sanderson and Son. It consists of a bond of five floors; a large building divided into two—one side duty-paid wine and spirit stores, on three floors, with about 40 vats for storing duty-paid spirits, and on the other side, a beer-bottling cellar in the basement, and three floors for the manufacture of aerated waters. The visitors inspected with much interest the making and bottling of the soda-water. They were afterwards entertained to luncheon by the Company. After lunch, the Chairman of the Company, Mr. W. A. Bevan, gave the visitors a most hearty welcome to the works.

E. (i.) Messrs. Locke, Blackett, and Co. Dutch Process of White-Lead Manufacture.

Conductor: Mr. W. W. Proctor.

Another section of the members visited the works of Messrs. Locke, Blackett, and Co., Gallowgate, where they had explained to them the process of white-lead manufacture by the Dutch method. The party, numbering about 20, left the Grand Hotel, Barras Bridge, at 9 o'clock, in a large brake. At the works they were received by the manager (Mr. Leathart), who conducted the visitors through the various departments, and explained the salient points in the manufacture. The metallic lead, purified from antimony and copper, is cast into thin sheets on grooved iron moulds. This "blue" lead, as it is called, is then subjected to the corrosive action of acetic acid vapour in large brickwork chambers. These chambers are about 12 ft. square and 20 ft. high; down the front there is left an opening about 3 ft. wide. The floor of the chamber is first covered with a layer of ashes, and on this is placed a thick layer of spent tan. Next, rows of earthenware pots containing dilute acetic acid are arranged alternately with rows of the lead castings placed on their edges. The layers of tan, pots, and lead are continued till the chamber is full, the layers being separated by boards. It takes about three months to convert the "blue" lead into white-lead, the process being facilitated by the heat produced by the fermentation of the tan, which volatilises the acetic acid in the pots, and also yields carbon dioxide. At the end of the time, the "blue" lead being corroded into white-lead, the stack is unloaded. The "corrosions" still preserve the shape of the "blue" lead, but have generally a core of metal remaining. The "corrosions" are wetted, removed in wooden trays, and transferred to a mill. The corrugated rollers of the mill are made of gunmetal, and, after the "lead"—which is wetted to keep down dust—has gone through them, it passes into a shallow tank of water, with a perforated false bottom, which separates the "blue" lead from the white-lead, the latter passing through and on to a grinding-mill; any "blue" lead remaining is remelted and used again. The final process of making paste white-lead involves the addition of linseed oil, which squeezes out most of the water, that remaining, being driven off by heating in vacuum chambers. As is well known, the manufacture of white-lead is an industry attended with not a little danger to health; so much so that Parliament has passed very stringent regulations in the interests of the workpeople. One of these is the compulsory wearing of respirators in certain departments, such as the white beds, the tanks, and the rollers. At one time a great number of women were employed at works of this description, but a short time ago the Government passed an Act prohibiting women from touching the white-lead, and now the comparatively small proportion of female workers engaged in these factories are only permitted to deal with the preliminary processes, in which ordinary lead is refined, &c. The particular affliction to which the workpeople are subjected is colic of the stomach, but there are other ailments, one of these being wrist-drop, which men are liable to suffer from who work with their hands in contact with the white-lead. All precautions are taken by the manufacturers to render a dangerous employment as little harmful as possible, but it must be confessed that these efforts are not infrequently minimised by the carelessness of the workmen themselves. Mr. Leathart was heartily thanked by the members for his kindness before they left the factory.

E. (ii.) The Redheugh Gas Works of the Newcastle-upon-Tyne and Gateshead Gas Company.

Immediately on leaving the white-lead works of Locke, Blackett, and Co., the visitors proceeded by brake to the Redheugh Gas Works, the special features to be noted here being the mechanical charging of the retorts, and sulphur recovery in the Claus kiln. The following is a description of these works:—

The *Redheugh Gas Works*, in the borough of Gateshead, is one of the stations of the Company and situate on the south side of the river Tyne. (The Company's only other station is at Elswick, on the north side of the river.)

The visitors were received by Dr. L. W. Adamson, Deputy Chairman of the Newcastle and Gateshead Gas Company, Mr. E. A. Hedley and Mr. W. R. Plummer (Directors), with Mr. Thomas Waddom (Secretary). The officials of the company who conducted the party over the works included Mr. W. Doig Gibb (engineer to the company), and Mr. Thomas Hardie, son of the late secretary, who is manager of the Redheugh Works. It was pointed out to the visitors, who were given a hearty welcome by Dr. Adamson, that the Redheugh Works did not form more than a part of the producing power of the company, which also has works at Elswick and a new establishment at Walker. The Redheugh Works are capable of producing 8½ million cubic feet of gas in 24 hours, whilst 5½ million cubic feet per diem can be turned out at Elswick. Both establishments, however, will be eclipsed in time by the works just erected at Walker. The St. Anthony's Works of the company, as they are termed, are intended to cope with the ever-increasing demand made upon the resources of the company, and though at first they will not be tested to the full, their ultimate capacity will reach the enormous total of 15 million cubic feet per day. It will be seen, therefore, that the Walker establishment, when tested, will be capable of producing a greater supply of gas than the works at Elswick and the Teams put together. Nor is it expected that, even with these additional facilities, the Gas Company will be able to cope with the enormous demand made upon them for more than about 15 years to come. This is an interesting proof of the rapid growth in population of the district.

The gas at these works is made from unscreened Durham gas coal enriched with about 5 per cent. of cannel obtained from local sources.

The maximum daily make of gas is 10¼ million cb. ft., to produce which nearly 930 tons of coal are carbonised; over 170,000 tons of coal are carbonised annually.

There are four retort houses, in three of which the coal is charged into the retorts and the coke withdrawn by hand labour, about 3 cwt. of coal being the amount of each charge. In the fourth house the coal is charged into the retort and coke withdrawn by means of machinery driven by compressed air. In this house each charge consists of about 3½ cwt. of coal. In all the houses the coal remains in the retort for six hours, at the end of which time it is drawn as coke and a fresh charge put in. The retorts are generally heated by regenerative furnaces. Some of the settings are heated by means of a furnace at one side of the bench only, and others by furnaces at both sides. The retorts are 22 ins. × 15 ins., ⌓-shaped, and 20 ft. long.

Each retort house has an independent purifying plant and station meter, so that the output of each is accurately ascertained. The gas from the retort house is drawn by means of an exhauster through an atmospheric condenser, where it is cooled to about 60° F. and then forced through scrubbers and purifiers to the meters and gasholders.

There are three tower scrubbers about 45 ft. high to each section; they are each filled with about 44,000 superficial ft. of wooden boards, with spaces between, through which water or weak ammoniacal liquor trickles down. At the same time the gas passes upwards, and in doing so the whole of the ammonia therein is removed, as is also about 15 per cent. of the carbonic acid and sulphuretted hydrogen.

There are six purifiers in each section and four tiers of lime about 5 ins. or 6 ins. thick in each purifier. The first two are used to remove the carbonic acid, and the remaining four, the sulphuretted hydrogen and carbon bisulphide. About 45 lb. of lime are required to purify the gas from one ton of coal. The gas produced, has an illuminating value of 16 sperm candles, as tested by the London Argand burner and contains about 8 grains of sulphur per 100 cb. ft., and is completely free from sulphuretted hydrogen or carbonic acid.

The sulphate of ammonia works are capable of producing 60 tons of sulphate per week. The sulphuric acid used is made from pyrites and consequently contains arsenic. This impurity is removed before the acid is used, by precipitation as sulphide by means of the sulphuretted hydrogen in the waste gases from the still. The free ammonia in the gas liquor is driven off in the still by means of steam, but the fixed ammonia, in the condition of chloride, thiosulphate, and thiocyanate, requires also mixing with milk of lime for its liberation. The sulphate is ejected from the saturator by means of a steam ejector and deposited on the draining table. The waste gases from the still are condensed and sent forward to a Claus kiln, where they are mixed with air and passed through oxide of iron, during which process the sulphuretted hydrogen is converted into free sulphur. This is deposited in brick chambers. Any sulphuretted hydrogen or sulphur dioxide going forward is caught respectively by means of an oxide of iron purifier or limestone tower.

After inspecting the works, the visitors partook of an excellent luncheon, by invitation of the Gas Company. A number of toasts were given and honoured.

Dr. L. W. ADAMSON, who presided, trusted they had found their visit pleasant and enjoyable. There were many features of their works, he believed, which were absolutely up to date, and having seen them, they had seen everything that modern science, in reference to gas manufacture, could put before them. He had been very glad, along with the other directors of the Company, to see them that day, and without trespassing further on their time, he would conclude by wishing the Society of Chemical Industry every success.

Mr. W. W. PROCTOR (conductor of the party), Dr. TRECHMANN, and Dr. LEWKOWITSCH replied, and thanked the directors for the very kind reception and entertainment accorded them. Dr. Lewkowitsch said the visit had been rendered much more enjoyable by reason of the lucid explanations given by the officials of the Company, and he asked the visitors present to drink their health. The toast was honoured, and Messrs. Gibb and Hardie briefly responded.

F.—NORTHUMBERLAND COUNTY COUNCIL'S EXPERIMENTAL FARM, COCKLE PARK.

The train left the Central Station at 1.30 p.m. for Longhirst. Conveyances awaited the train at Longhirst, and conveyed the visitors to Cockle Park, where, after an inspection of the farm, afternoon tea was kindly provided by the Northumberland County Council, conveyances returning to Morpeth Station in time for the 5.45 p.m. train back to Newcastle.

G.—ELSWICK ORDNANCE WORKS. (See D. (i.).)

H.—MESSRS. MALING'S FORD POTTERIES.

Excursion abandoned owing to the smallness of the number of applications. The indebtedness of the Society and Newcastle Section are none the less acknowledged for the kind invitation extended to the members.

J.—MESSRS. THE UNITED ALKALI COMPANY'S ALLHUSEN WORKS.

In referring to this visit it is impossible to avoid recalling a former one in 1884, when the Society, under the Presidency of Mr. Walter Weldon, F.R.S., came to Newcastle. A paragraph in this Journal 1884, page 396, and a glance at the annual photograph of members, then taken in one of Messrs. Allhuson's sulphuric acid chambers, will somewhat pathetically recall one of the most interesting events of that annual gathering, the central figure of which was so soon removed by death.

On the former occasion, the principal exhibit was that of the burning of pyrites in the Schaffner and Helbig's shelf kilns; on the present occasion it was that of the recovery of sulphur by the Chance process. The following is a description of it.

This plant was started in July 1890, and a full report of this process was given by Mr. Chance in a paper read before the London section of the Society of Chemical Industry, on March 5th, 1888. (See this Journal, 1888, 162—179.)

To those not directly connected with the industry, the following brief outline may suffice to follow its working.

The alkali waste, containing from 10 to 12 per cent. of sulphur, existing chiefly as calcium sulphide, is mixed with water to form a slurry, indicating from 40° to 50° Twaddell.

This slurry is pumped into cast iron vessels (carbonators), through which the CO_2 gas, produced from burning limestone in specially constructed limekilns, is passed.

The gas from these limekilns contains about 30 per cent. of carbonic acid, along with small quantities of oxygen and carbonic oxide, the remainder being nitrogen.

The decomposition which takes place in the carbonators may be divided into two stages as follows:—

1. $CO_2 + 2\ CaS + H_2O = CaCO_3 + CaH_2S_2$
2. $CO_2 + CaH_2S_2 + H_2O = CaCO_3 + 2H_2S$.

The sulphuretted hydrogen gas from the carbonators is passed into a gas holder, and contains about 25 per cent. of H_2S, the remainder being principally nitrogen from the limekiln gas.

A supply of air, regulated by meter, and just sufficient to burn the hydrogen of the H_2S gas, is mixed with the holder gas before entering the "Claus" kiln according to the following equation:—$H_2S + O = H_2O + S$. The temperature of the gases leaving the "Claus" kilns varies from 400° to 450° F., sufficient to keep the sulphur in the liquid state, and the water in the form of vapour

The sulphur is obtained in the pots situated near the "Claus" kilns, and is tapped into pans, where it cools and solidifies.

In order to arrest the sulphur which is carried forward with the exit gases in the form of vapour, large chambers, with division walls to present as large a surface as possible for the sulphur to deposit on, are provided.

K.—Messrs. Palmer's Shipbuilding and Iron Company, Ltd., Jarrow.

For this excursion and visit, the visitors left the Central Station, Newcastle, at 2.10 p.m., and after their inspection of works, &c. returned from Jarrow at 5.33, reaching Newcastle at 5.55 p.m.

During the afternoons of Wednesday and Thursday the following works and places of interest were open for inspection to the members on presentation of the card of membership:—

The Newcastle and District Electric Lighting Co., Ltd., Forth Banks.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., Paudon Dene.

The Northern Counties Ice Making and Cold Stores Co., Ltd., Quayside.

The "Newcastle Chronicle" Printing Offices, Westgate Road (at 3.15, 4.15, or 5.15 p.m.)

The Castle and Black Gate Museum were also thrown open to the visitors on these afternoons by the kind permission of the Society of Antiquaries of Newcastle-upon-Tyne.

The Annual Dinner.

The annual dinner of the Society was held on the evening of Thursday, July 13, in the Grand Assembly Rooms. The President of the Society (Mr. George Beilby) occupied the chair, and was supported on the right by the Rev. Principal H. P. Gurney, Mr. Samuel Hall, the Mayor of Newcastle (Mr. George Harkus), Mr. Thomas Tyrer, Mr. T. W. Lovibond, Mr. John Heron, Mr. A. M. Palmer, Mr. W. F. Reid, Mr. A. Smetham, Mr. Thomas Waddom, and Dr. C. A. Kohn; and on the left by Mr. David Howard, Prof. G. H. Philipson, Mr. F. S. Newall, Prof. F. Thorp, Prof. G. Henderson, Mr. Thomas Carrick, Mr. E. C. C. Stanford, Mr. Charles J. Potter, Mr. Oscar Guttmann, Mr. G. B. Hunter, and Mr. John Pattinson. The vice-Chairmen were Mr. Alfred Allhusen, Prof. P. P. Bedson, Mr. W. L. Renoldson, and Mr. N. H. Martin.

An excellent dinner was provided by Messrs. Tilley. During the evening, an enjoyable programme of music was rendered by Mr. R. Smith's, band, conducted by Mr. J. H Beers.

The toast of "The Queen" having been honoured,

Mr. David Howard proposed the toast,—"The Society of Chemical Industry." He said: Mr. President and gentlemen, a rather heavy responsibility has been put upon me —one which I would willingly have left to one younger and more able to fulfil it. And yet it is just because I can speak with considerable age and experience—having been one of the very earliest members of this Society—I will speak from the point of view of age, with its accompanying disadvantages. As one gets older, one gets used to a good deal of disillusionment. One finds one's early hopes vanish. One has disappointments. That of which one hoped much has turned out very little. There is a certain cynical criticism which grows upon one. Mr. President and gentlemen, I venture, without hesitation, to turn that cynical criticism upon the Society of Chemical Industry, and boldly ask whether that, too, has been an illusion; has that, too, been a failure? I think that the record which we have heard of our present and ever-increasing numbers; I think the fact that our Journal is valued all over England, and over Britain, all over the Greater Britain, and, if I may use a new word, over that Greatest Britain wherever the English language is spoken; I think if we take up that Index which at last we have—we ourselves and not our heirs, as some of our members expected—and if we read it critically, as the old lady read Johnson's Dictionary, I think that we too shall find that, though a little disjointed, it is very interesting; it is very interesting as showing the vast mass and ever-increasing mass of knowledge which has to be classified and utilised by those who would keep in the front of applied chemical science. Considering all these things, I do not think that the Society of Chemical Industry has been a failure. But I think it is well to consider a little what has been the cause of our success, and then, at any rate, we shall be prepared to go forward with some good faith that the future shall be even more successful than the past. Now, this morning and afternoon, it has fallen to our lot to see a great deal that is not strictly chemical industry. People may have said, "Why are you troubling yourselves with engineering? What have you to do with it?" I think that the man who thinks only to study that which is immediately useful attains to the exact level of intelligence of the costermonger's donkey, who runs after the carrot carefully kept in front of him, and with the same unhappy effect. The donkey never gets that carrot, and the man who never seeks beyond the immediately useful never gets what he wants. It is only in a wider, and broader, and deeper current of thought that one can find that training of the mind and the intelligence which is required for the ever-widening and deepening currents of difficult problems with which we have to cope. We have been studying engineering, we have, as I say, been studying things with which we immediately have nothing to do. We have had an opportunity of seeing perfect adaptations of powerful machines to the manufacture of marine engines and marine boilers—an example of the adaptation of means to an end, which is the great secret of modern success. We have had another curious adaptation of means to an end in seeing certainly the most rapid progress through the water I ever saw, or rather, not through the water, but almost over the water. We have seen the performance of a boat, I suppose it was, but it looked more like a dragon as it passed us, performing in a way which, certainly, a couple of hundred years ago, would have ensured at least the stake, if not something worse, for the inventor, on the charge of having indulged in something more than the lawful arts. We have seen practical applied science on a scale of a good many thousands of tons, in the wonderful perfection of modern shipbuilding. We have seen such triumphs of engineering as some of us will not soon forget. And we shall each do our best to apply these examples of co-ordination of the means to the end in our own humbler and much smaller spheres. It is the same principle which is at the bottom of both We all know how to split a piece of ice. We can do it in a wine glass with a pin. The question is how to split ice two metres thick. That is not done with a pin. We all of us can cut ribbon with a pair of scissors; but can we think out a pair of scissors, or rather one scissor, which will cut the ice two metres thick? We have seen how it is done by the "Ermach" — the application on a vast scale of something supremely simple. Wherein does the modern engineer differ from the ancient smith? I am bound to say the aforesaid smith, if he were surviving now, would be a first-rate workman. Whether he would be a trades unionist, amenable to trades union discipline, I have grave doubts. The engineer is not merely the man who makes the engine, but the man who works by the engine, not by a tool. There is the whole difference, a whole æon of difference, between the work of the smith and the work of the engineer. The one is a simple thing; the other is its application, not only on a larger scale, but in a totally different sphere. The problem of the smith who makes a horseshoe is something vastly different from the problem of the engineer who curves and moulds those wonderful plates that we saw, with the most delicate curves—so moulds them that they go up into their places with that wonderful silence with which the modern engineer can lift vast weights. I don't refer to the riveting, which is not quite up to date; we have not yet got the ideal riveter, who will put that plate in position without a noisy process. The great difference is, that the work of the modern engineer is and is not the same as the work of the ancient smith. It is the same, on a much larger scale. It is not the same, because the thought, the whole science, is in a different plane. It is thinking on a vast scale. What we want in chemical industry is just the same differentiation from scientific chemists. They aim at absolute perfection. We have to do our work as perfectly as we can, with hundreds, thousands—any other number of tons. The process is the same, the science is the same, but the application is, as I have said, in a different plane. It looks as if there were no great difference; and yet anyone who knows what it is to have perfect success in a test tube, and what it is to carry the same reaction out on a large scale, knows what I mean. It does not matter if you burn a little more gas which costs only 3*s.* to 3*s.* 6*d.* per thousand feet. But it does much matter where you burn just a little more coal, and multiply it by a million. These little minute details, which we cannot even realise in the experimental laboratory, make a question of success or failure on a large scale. These are the problems with which we have to deal. Now, it has been our good fortune, during the past year, to have had a President who is a distinguished example of that particular distinction which I have been trying to emphasise. That paper which he read to us, to which we listened with such extreme interest—and which a good many of us will study very carefully when we get home—that paper is exactly an example of that application of extremely simple science which every seventh-standard board-school boy thinks he knows. And yet, though it is so perfectly simple—only give your carbon enough air and it burns out and leaves no smoke—it is not quite so easy in practice. I don't think that the average manufacturer in Newcastle is far from a wise man; at any rate, down south we have a strong impression that they are born as clever here as we are, and yet they make a shocking smoke. There is one of those problems on which the future of England largely depends—the economy of coal—and which is within the scope of the immediate requirements of every one of the members of the Society of Chemical Industry. These are the problems we have to solve; and, as I say, we have a representative President, whose name I couple with this toast. Before I sit down, I must say that it is an extreme gratification to me to feel how wide the links of our Society are. Our incoming President comes from the other side of the Atlantic; and that points to the circumstance that modern science has bridged over the ocean with those vast machines —I can hardly call them ships, because they are something which in the old days of our forefathers would have been never dreamed of—and the other side has been brought so near to us that, after seeing that vast vessel to-day, we cannot say how few days will be required to cross. I propose the health of the Society of Chemical Industry, coupling with it the health of our President.

The toast was cordially honoured.

The **President**: Mr. Howard and Gentlemen,—I have not the age and experience of which my friend, Mr. Howard, spoke, and I cannot, therefore, pretend to keep you enthralled and delighted as he has done for the past 10 minutes. But I can certainly thank you very much, for the kind way in which you have coupled my name with the toast of the Society, and I have very great pleasure in saying a few words on our position, at the moment, as a Society. That position is one of great hope. I have never felt more hopeful of the Society than I do now, after having had the fullest experience of its entire working for the year, thanks to your kindness in placing me in the position in which I might officially visit all the sections on this side of the Atlantic. That I have regarded as a very great privilege, and as a very great education to myself. I have profited by it in many ways. It has been a stimulus to me, and a very great encouragement to me; and I delight, on this occasion, to again thank all the sections, with whom I have had very pleasant converse during my year of office. These visits which I have been privileged to pay have raised an increasing hopefulness in my mind as to what the Society will do in the future, in carrying out its task ably and successfully, as it has done in the past. I think, perhaps, if our Society has had a fault recently, it has been that we have carried the modesty of youth a little too long. We have really forgotten that we are a large and a very powerful Society. We have met once a year, and we have told each other that we were very large, that our membership was now in the region of thousands; but I do not think that, at bottom, we have really very much believed in our greatness. I think that phase is distinctly passing away. I think we may look upon ourselves fairly, as bulking more and more in the technical world as a real and a great power. My ambition for the Society has always been that it should be a very great power, second to none in the technical world. I think chemistry is at the bottom really of all industry, and I am not inclined to allow any other branch of industry to carry off the palm which I think belongs to it. My parting wish for the Society is—that you should become more and more conscious of your strength, and that you should use that strength to increase your influence in the world of industry. It has been a gratification to me to have had the honour of receiving the Mayor; because I have regarded it as absolutely necessary, for this power of ours to be felt and recognised, that we should have official recognition in the great commercial communities of the country. I am delighted to think that the Mayor will in future look very favourably upon the work of the Newcastle Section of the Society of Chemical Industry, and will use his great influence to forward the objects which I know you have at heart, and make you an increasingly influential body. It is most gratifying to find the close association which continues between the Section and the universities and university colleges in these industrial towns. That, I think, is an enormous source of strength from which we have derived great benefit in the past. How our sections would have survived the maladies of infancy, and come through these into manhood, I cannot conceive, unless we had had the help of the professors and the teachers in these universities and colleges. They have done yeoman work for us—work that has not, I think, always been fully appreciated. I hope that in the years before us the professors and teachers and principals of our colleges will work together increasingly with those who are in practical touch with industry in all parts of the kingdom, and that, by this happy combination, our Society may go on increasing in strength, till it becomes very great among the technical societies of the world.

Mr. **F. Stirling Newall**, Chairman of the Newcastle Section, rose to propose the health of the Mayor of Newcastle. They had to thank the Mayor, he said, for his very graceful welcome of their Society to the city of Newcastle. They had to thank him for his kind hospitality in the Leazes Park on Wednesday, and they had to thank him for his presence there that night. He hoped that the civic authorities would take the advice of the President, and attend the College in Newcastle, and take a more prominent part in their meetings.

The **Mayor**, responding to the toast, which had been warmly received, said he was much obliged to Mr. Newall for his kind remarks in proposing the toast, and he thanked the members of the Society for the hearty manner in which they had received it. When the City Council knew that the Society of Chemical Industry was going to visit Newcastle, they did all they possibly could to ensure the meeting being a pleasant one. He was sorry that the weather was against them on the previous day at the garden party, but for their excursions that day they had had glorious sunshine. They were going on the following day to Cragside, and, if the weather was fine, they would find the visit charming.

Mr. E. C. C. **Stanford** proposed "Science and Industry." He said he had to go back 36 years to mention the first time that he had experience of the great hospitality of this great city of Newcastle. And he found it had not deteriorated since then. His host, Mr. Martin, had entertained two of the past Presidents of that Society, and had had his hands full. Going back to a former time, he could not help thinking of the period when he used to pass that High Level Railway going from Scotland to England. At that time they had not the great advantages and luxuries of railway travelling that they had at present. They could not have any sleeping carriages or Pullman cars, or anything of that sort. They had to bribe the guard to get them a first-class compartment to themselves, and to give them a couple of sticks to stick up a cushion across. Thus they could snatch a little slumber now and then. They always arrived at every station with a jolt and a jerk, and they always left every station in the same way. And, he remembered, they always woke up at all these stations. He remembered, most of all, the impression made upon his mind when they woke up at Newcastle, and looked out, in the middle of the night, on that great hive of industry, going at full steam across the River Tyne. That great hive of industry formed the subject of his toast, because it was the science and industry of the city of Newcastle. Well he remembered, when first he came to Newcastle, asking what the town was named after, and he was told that it was the New Castle—which, even then, seemed to be a little out of repair and wanted pointing. In those times he remembered the river Tyne very well. There was a considerable bar at the other end of it, but he believed that had now been entirely removed. Then, in addition, outside the harbour, there was a bank, which was a cause of great anxiety to many passengers who approached Newcastle by the sea-way. That bank still existed to a certain extent. He remembered very well the engineer who carried out most of the work of improving the Tyne—he meant Mr. John F. Ure, who died some time ago in Glasgow. He supposed that, in referring to the industries of Newcastle, he ought, in the first place, to talk about coal. He thought, when he first came to Newcastle, it would be rather a good thing to put in his pocket a little of that splendid coal that they produced in Scotland—he meant that smokeless variety that their President had been talking about, which they consumed on the Clyde. But he had learned, in an early part of his life, that it was no use carrying coals to Newcastle; and he thought he might add that later experience showed him that it would not be much use bringing smoke either. He believed that the great industry next to coal in Newcastle was grindstones. So he had been told, at any rate; and those of them who, like himself, constantly had their noses on that instrument, would quite appreciate the value of that commodity. Well, the next industry must be shipbuilding. He did not know in what position it stood just at present; but he knew that the last time he was here, a few years ago, it was not doing well. The shipbuilding yards were silent, and he remembered that a great number of steamers were lying idle in the Tyne. He was extremely glad to see that day that they were all away, and that shipbuilding was better than ever. Though he did not know exactly what rank the Tyne took at present—whether it was at the top, or second or third—he knew it was very high; and he did not know this—he had learned it that day—that at any rate they had built the fastest boat; and that was something to be proud of. They had built also that great ice-breaker, which he believed, was one of the greatest novelties of present naval architecture; and they had performed the extraordinary feat of taking a vessel off the rocks by means of blowing her up, and then taking one of the halves home and stitching on another end to her. That was something to be proud of. Then he must allude, of course, to that immense works which many had seen that day, the great ordnance, engineering, and shipbuilding establishment which was inseparably connected with the name of Lord Armstrong. They not only built ships, but they put in the guns, and everything requisite to defend our coasts. And then he must say something about the alkali trade, which, it appeared, was not quite so flourishing as when he was there last. But they must not forget that that was the great cradle of the alkali trade. That was the place where they first began to bring in the Leblanc process, which, with all its difficulties and disadvantages, had stood an astonishing number of years in the forefront of the alkali trade. If it was threatened, he believed that Newcastle men would know how to meet it. If new plans had to be adopted, he did not see why they could not be adopted there as well as anywhere else. One could not forget the great names of the alkali trade associated inseparably with that city. He referred to Mr. William Losh, and he also spoke of George Stephenson, because George Stephenson was, he believed, some time in the employ of Mr. William Losh, and they together took out a number of patents in Newcastle-on-Tyne. There was no better combination of chemical engineering than those two men. He himself (Mr. Stanford) claimed some connection, very distant, with Mr. William Losh. In times past industry had led, and science had followed. He hoped they were beginning a new era, when science would begin and industry would follow. They were arranging that the next generation—whatever we were—should be properly educated. They had a splendid college of science, and he was quite sure that, by-and-by, when the young men took full advantage of such colleges of science, this country would not be behind.

Prof. P. **Phillips Bedson** (Professor of Chemistry in the Durham College of Science, Newcastle) responded. He thanked them for the honour they had done to the position which he held in connection with the College of Science in that city, by associating his name with that toast. He need scarcely remind the members of the Society of Chemical Industry that a chair of chemistry was by no means an arm chair. The numberless applications of the science of chemistry—the most fundamental of the sciences—together with the rapid advancement of the science, made the position of the teacher of chemistry by no means an easy one. They were attempting to do much in the hope and in the ideals of the first great teacher of chemistry, who founded, years ago, the first educational laboratory, which marked an epoch in the history of our times, and also marked an epoch in the history of science and the application of chemistry to industrial purposes. Need he say he referred to Liebig, whose laboratory on the Lahn Prof. Thorpe had so beautifully described as "the little leaven that leaveneth the whole." And if their laboratories at the present day might claim descent from that one at Giessen, surely they, too, might lay claim to something of the spirit and of the ideal which actuated the founder. He should imagine, from his life's work, that nothing would have given him greater zest and keener pleasure, than to aid in some way the application of science to industry. At the present time they still heard, and not infrequently, "theory" and "practice" spoken of as if there were some natural antagonism between the two; and not infrequently did they hear professors and men of pure science styled "men of theory." He did not wish to claim all the virtues for the men of theory, nor would he allow that the man of practice had a monopoly of all useful knowledge. When they looked back into the history of the past fifty years, they must be struck by the rapid advance of the application of discoveries brought about by pure scientific research; these discoveries being at once applied to the foundation of industries, to the benefit of mankind, and the furthering of that triumph which they all aimed at, namely, the triumph of mind over matter. The man of theory, who had consistently advocated devotion to scientific research, might claim in these an ample justification to be regarded as a practical man. At the close of this nineteenth century we had already entered upon a condition of affairs which might fittingly be described as the age of science. And in the race for industrial supremacy the prizes would undoubtedly be to that nation which was most careful to see that science in all its branches was cultivated and cared for; and also they would be to that nation which was most successful in blending science with industry. Before he sat down, he would venture to express the hope that we should in this country see more of this blending of science and industry than had hitherto been the case; more especially when they saw the success which had been met with in other countries. If this blending were more fully carried out, then young men would see that in educating themselves as chemists they were educating themselves to fill a career—an industrial career—which was worthy of the science, worthy of the time and money that had been expended in their preparation.

Mr. G. B. Hunter (Newcastle-upon-Tyne, of the firm of Messrs. Swan and Hunter, shipbuilders) also responded to the toast. He said it was characteristic of our age, and very right and fitting, to associate science and industry, as had been done in the toast which they had so kindly received. Science, of course, was the master of industry; but it was also the servant of industry. And it should always be the inseparable companion of industry too. The time of a system of guesswork had, he thought, passed away. The good old rule of thumb served them very well in its time, especially when there was an amount of common sense and a skilled mechanic behind it. And he thought they would always have use for the rule of thumb amongst their workmen. But they wanted something more now. He thought that they English had permitted the rule of thumb, perhaps, longer than any other nation. But they were going to give it up as a system to work by, and he thought that when they had done that, and it was gone from England, it would have gone from everywhere. The branch of industry that he belonged to had certainly benefited very largely from science. It was not always so. In the old days of wooden shipbuilding, which he remembered very well, there was a great deal of industry. The old north-country shipwright was a noble fellow—a hard-working, intelligent fellow—but there was not much science. Even in the early days of iron shipbuilding, there was not much science either. These were the days when it was said that to begin shipbuilding all that was wanted was a field and a punching machine. They had got beyond that; as he hoped they had realised in their visit that day. They had prospered to a certain extent. He did not know how men of science were doing, but he knew that their industry was prospering; and he was sure that it must be a great consolation to them, if they had not prospered themselves, to go down the river and see the marked signs of prosperity around them. Some of them might remember what Mr. Gladstone said, many years ago, when he was there. He said that, amongst all the great industrial centres of this kingdom, he thought there was no stretch of land which showed more industry, more progress, and more prosperity, than the few miles which extended from Newcastle to the seaside. But appearances were sometimes deceptive, and he knew many industrial concerns there where the dividends were exceedingly small. Of course, he was not going to complain. He should say this, that nothing was to be gained in these industrial enterprises without hard work. And he should say that the good times they were passing through would not last. He did not know that they could afford to have them last, because it was not always when there was most work going on that most profits were made. He need not say much about that; they certainly would not last always; a time would come when they would pass away. But it was very consoling, at any rate, to know that the great industrial population were prospering. Work was plentiful, wages were high, and happily at the same time the cost of living was abnormally low. The men were prospering, and he hoped that in spending what they earned they would spend as little as possible of it in that worst of all methods of spending it on drink—and save as much as they could against the time when things would not be so prosperous as they were then. It was good for all of them to save; it would always come in useful some time. It gave him great pleasure to respond on behalf of industry to that toast.

Prof. G. G. Henderson (Chairman of the Scottish Section) proposed "The Guests." Every member of the Society of Chemical Industry who had had the privilege of attending that most admirable meeting had been welcomed with such cordiality, and with such lavish hospitality, that they were filled with delight at having an opportunity such as that of giving some recognition, however imperfect and inadequate, for the way in which they had been treated in Newcastle. He was glad to think that their meeting was, in a sense, a very representative one. Though their President-elect had been unable to come, they had a representative from across the sea in the person of Prof. Thorpe, and in the person of Mr. W. F. Fuerst, and they had a representative of their continental friends in Prof. Cronquist, of Stockholm. It was peculiarly delightful to submit that toast to them, realising that amongst those whom they delighted to honour in that way they found the Rev. Principal of that College, and the President of the Medical College. It would be most unbecoming on his part to say a word about those gentlemen, in their own native town. But he might, on behalf of the members of the Society, congratulate the Principal upon the beautiful building and the admirable educational facilities which he had for imparting that training in pure and applied science which was the life of industry. The medical school was famous everywhere, though he must confess that, considering the exceptional purity of the atmosphere which had been so impressed upon them in their visit there, it was difficult to see how there could be any medical side to the school to be flourishing. One could understand the great surgical development, but the medical side ought to be almost at a standstill for want of patients. He had, in the name of the members, the greatest pleasure in proposing the toast of "The Guests of the Society," coupled with the names of the Rev. Principal Gurney and Dr. Philipson.

The Rev. H. Palin Gurney, M.A., D.C.L., F.G.S. (Principal of the Durham University College of Science, Newcastle), responded. He said he felt it to be a very great honour to have been asked to reply to that important toast, which had been so felicitously proposed to them by Prof. Henderson. He could assure them that the Council and staff of the Durham College of Science in that city had had the greatest pleasure in placing their buildings at the service of the Society of Chemical Industry for that meeting, and in offering them a very hearty welcome. He reminded the members that they paid a visit to the College some years previously, and that they were not only the guests of the College, but—if he might with all due respect use such an expression as applied to that important Society—they were their house-warmers. For they paid a visit to the College in their then newly-finished buildings, before they had been opened even for the reception of students. He ventured to hope that the accommodation which they had been able to offer them upon the present occasion had proved sufficiently satisfactory to them to induce them to repeat that experiment, and to receive their hospitality again at no distant date. He was also proud to be allowed to thank them for the delightful hospitality they had received at the hands of the Society. They had been told that from the nitrogen of the air in which they lived would be provided in the future the food which was necessary to sustain existence. If that industry were opened on the Tyne, he hoped they would remember the poor professors in the College of Science, and give them the opportunity of taking founders' shares.

Prof. George Hare Philipson (President of the Durham University College of Medicine, Newcastle), also responded to the toast. He said he had the pleasure of thanking them for their kindness in remembering the guests on their toast list. He felt it a very great honour for his name, as President of the College of Medicine in that city, to be associated with the name of his esteemed friend and valued colleague, the Principal of the College of Science, in returning thanks to them for their kind remembrance. He took it as an indication that they were desirous of showing their appreciation of the efforts which the College of Science and the College of Medicine were making to advance the cause of higher education in this northern district of England. There was distinct evidence that the Society of Chemical Industry was advancing. It was held in great respect, not only by those who were intimately associated with it, but by all who were interested in the advancement of industries in this country. He was glad to learn that chemical industry was recovering its former activity.

The **President** said they would be glad to hear a few words from Mr. Thomas Tyrer, who, he was sorry to say, for the first time almost in the history of the Society, was compelled, temporarily he hoped, to leave the Council.

Mr. **Thomas Tyrer** (London) said the observations which had been made by the President personal to himself had really nothing to do with the toast. He thanked the President for having mentioned his name in that connection. It was a fact that he had been continually on the Council, in one capacity or another, from the foundation of the Society. He would remind them that the early history of a society like theirs was apt to be forgotten. The index which their New York brethren told them would be due probably in 1999, was now actually before them. He might say it was born in the year in which he was President, and he held the first proof sheets. The first five years' indexes were of no use, and it was therefore necessary to re-write the collective index from the text, and that was really the cause of the delay. The names of his good friend Mr. John Spiller, Mr. George E. Davis, Mr. Carey, who was then honorary Northern secretary, Sir Henry Roscoe and himself, appeared on the first volume of the Society's Journal, and he was proud of his name appearing in such company as the first Publication Committee of that Society. He made that personal comment because the President was good enough to give him the lead. He was delighted to hear that night emphatic testimony on all hands of the excellent position to which the Society had grown. It was entitled to it; and all he could say was, that that was entirely due—he used the word "entirely," and he believed he would have the support of all past Presidents in saying it—was entirely due to the fact that they had sections. And the vitality of those sections depended upon the officers of those sections. If it were not for the enthusiasm of gentlemen who had held responsible positions at various times as chairmen and secretaries, or members of committee of those sections, the Society, notwithstanding its Journal, could never have been what it was now. If that were so, it led him at once to propose the toast of "The Newcastle Section." The name of their esteemed friend, Mr. Newall, was associated with the toast. Mr. Newall had indicated his sympathy and his profound interest in the Society by being, with his charming wife, their hosts on the previous evening. If that were alone the service which Mr. Newall, had performed, his association with that toast would have been amply justified. He was quite sure they would all admit that no chairman could work without excellent secretaries and coadjutors. In this case Mr. Newall had been absent, he believed, on account of ill health, and his place had been supplied by the Vice-President of the College, Prof. Bedson. He thought it only right to refer to him, although his name was not officially on the list. Then, as to the Secretary, he himself had had some experience, and knew what it was, and he was sure the greater part of the success was due to their friend, Mr. Saville Shaw, whose activity, readiness, and courtesy, and indeed every quality which a secretary should possess, had been manifested in a marked degree on that occasion. He wished every section in future such officers, such a secretary, such colleagues, such a chairman.

Mr. **F. Stirling Newall** (Chairman of the Newcastle Section) responded to the toast. He said Mr. Tyrer had alluded to his absence from home. That was not on account of his own health, but on account of his son's health. When he returned, he found that the Committee had worked so ably for the success of the meeting that everything was ready for him, and he simply had to approve of it. The success of the meeting was largely due to Mr. Shaw and Dr. Bedson and the Reception Committee. Although the Tyne chemical trade showed a great diminution since they were there in 1884, he hoped they would go away at the end of their visit feeling that there was no diminution in their hospitality. They had shown them their best and most wonderful things. He hoped they had enjoyed their visit, and that a period of 15 years would not be allowed to elapse before they paid another visit to Newcastle.

THIRD DAY.—Friday, July 14th.

Visit and Excursion to Cragside and Chollerford.

A large number of the members, together with their lady friends, visited Cragside and Chollerford. The excursion proved one of the most successful and enjoyable of the many held during the week. The party, to the number of about 150, travelled by special train, in saloon carriages, to Rothbury, where they arrived about eleven o'clock. By the kind permission of Lord Armstrong, C.B., they visited Cragside. His Lordship personally received and welcomed the President (Mr. George Beilby), Prof. Bedson, Newcastle, and Mr. N. H. Martin (chairman elect of the Newcastle Section). His Lordship provided luncheon for the visitors, at which Mr. W. A. Watson-Armstrong presided. Subsequently a vote of thanks to Lord Armstrong and Mr. Watson-Armstrong was moved by the President, seconded by Mr. F. S. Newall (chairman of the Newcastle Section), and very heartily accorded. The party were conducted over the charming grounds, &c. by Mr. Watson Armstrong and by Mr. Bell, Secretary to Lord Armstrong.

Leaving Cragside during the afternoon, the visitors took special train to Chollerford, arriving there about five o'clock. Here a visit was paid to the Roman Camp and the remains of the bridge over the Tyne, at the Chesters, by kind permission of Mr. J. B. Clayton. Tea was served in a large marquée by Mr. W. B. Pyle of the George Inn, and the return journey was commenced about half-past eight o'clock, Newcastle being reached an hour later.

FOURTH DAY.—Saturday, July 15th.

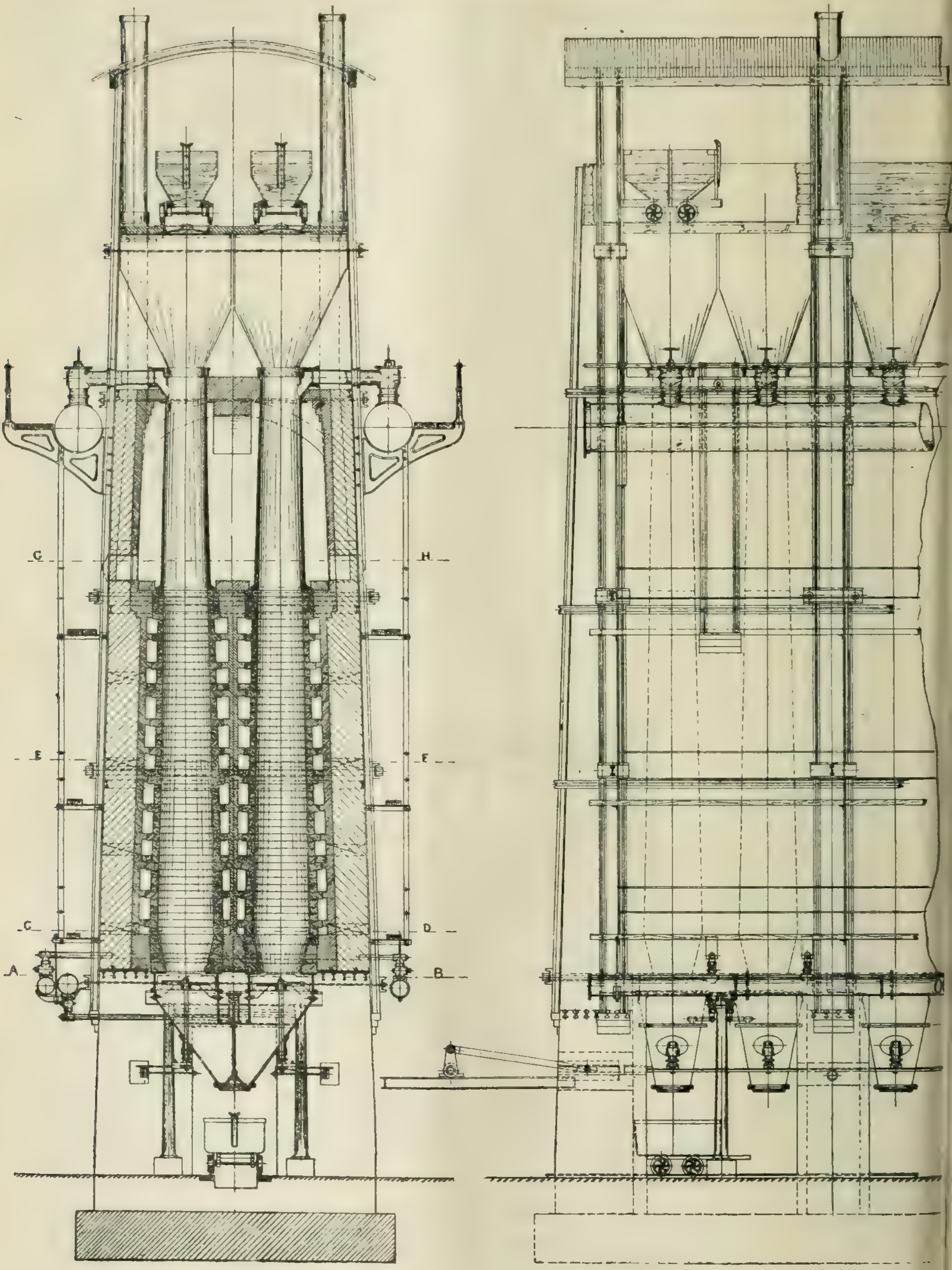
Visit to Durham Cathedral and Castle.

On Saturday about forty of the members and their friends journeyed to Durham. At the Cathedral they were received by the Very Rev. G. W. Kitchin, D.D., Dean of Durham and Warden of the University, who personally conducted the party over the Cathedral building and the Chapter Library. At one o'clock, luncheon was provided for the visitors at the "Three Tuns" Hotel, and the afternoon was devoted to an inspection of The Castle, formerly the residence of the prince, Bishops of Durham, and now the chief residential College of the University.

The Dean and Mrs. Kitchin afterwards received the members at the Deanery, where afternoon tea was provided on the lawn, and the party returned to Newcastle shortly after five o'clock.

This brought to a close one of the pleasantest annual meetings ever held by the Society of Chemical Industry.

APPENDIX TO PRESIDENT'S ADDRESS.



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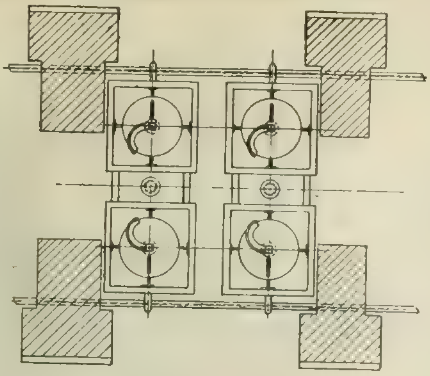
Pumpherston Retorts.



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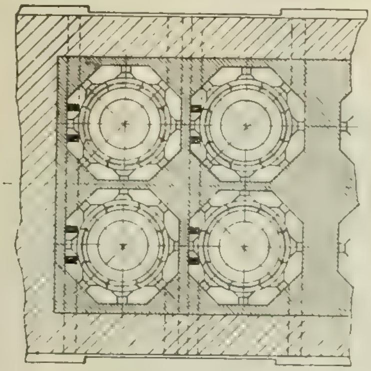

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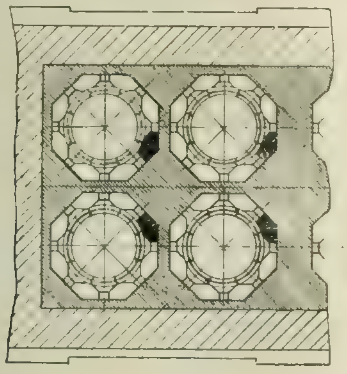

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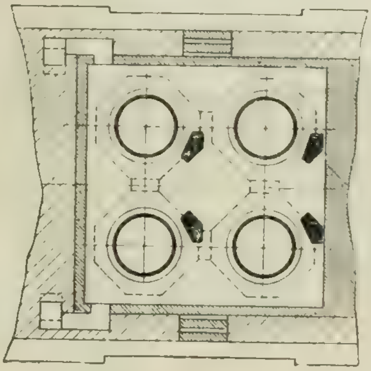

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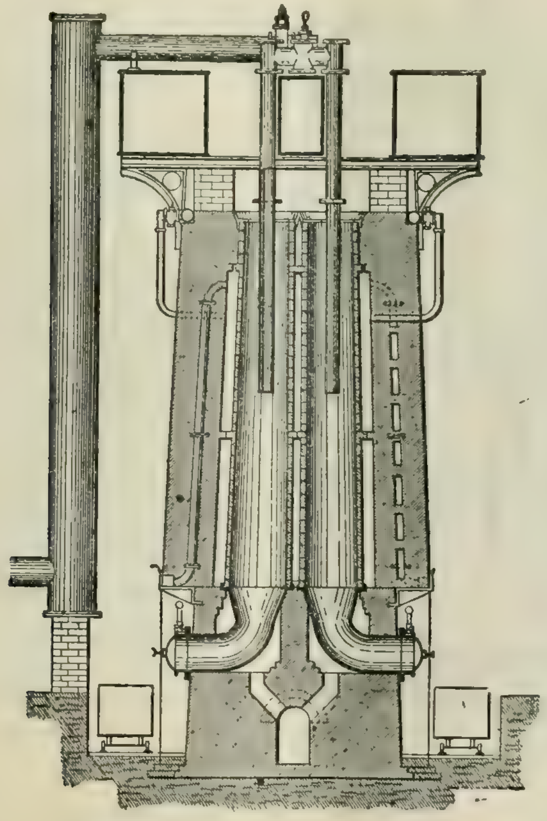
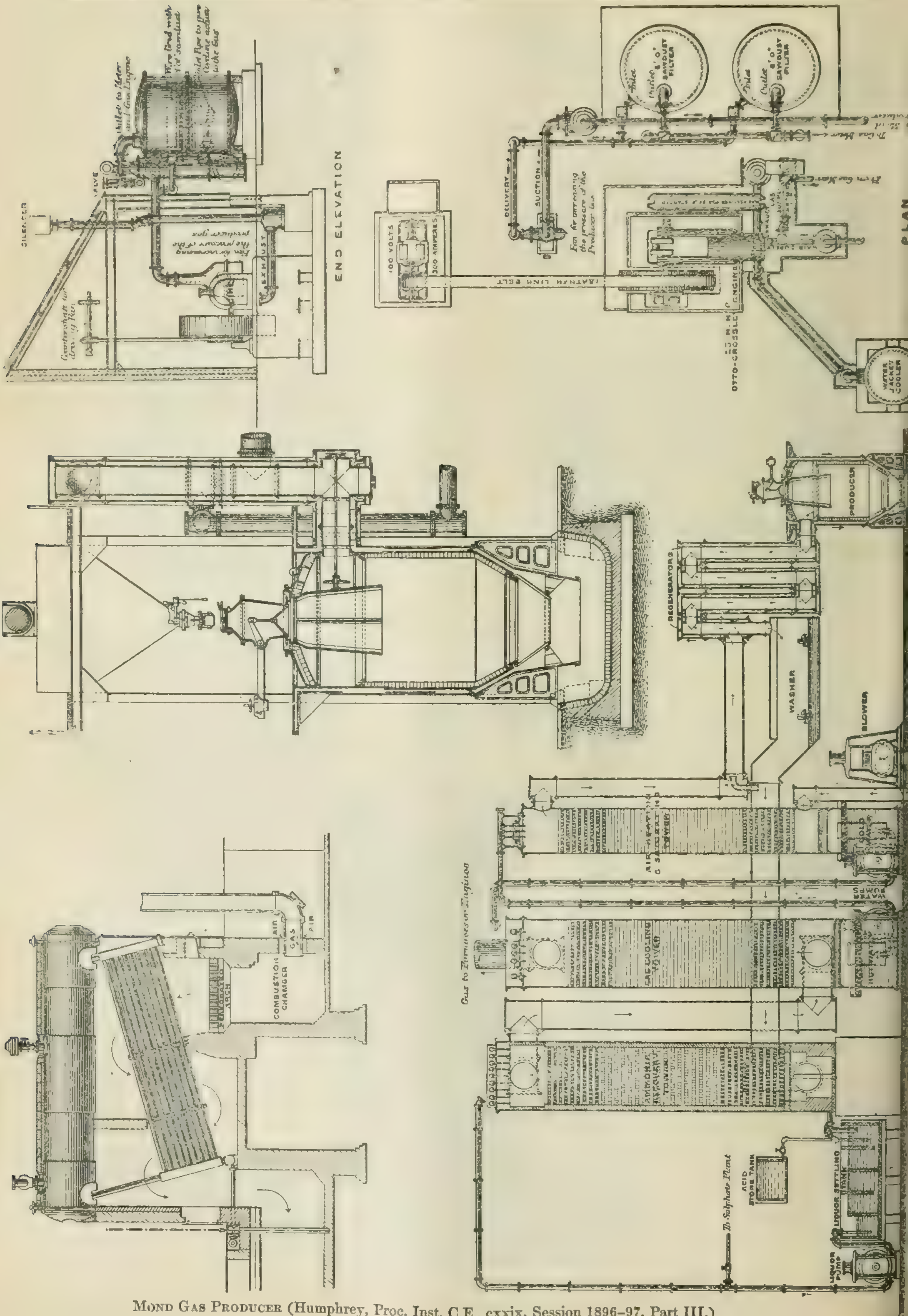
PUMPHERSTON RETORTS.



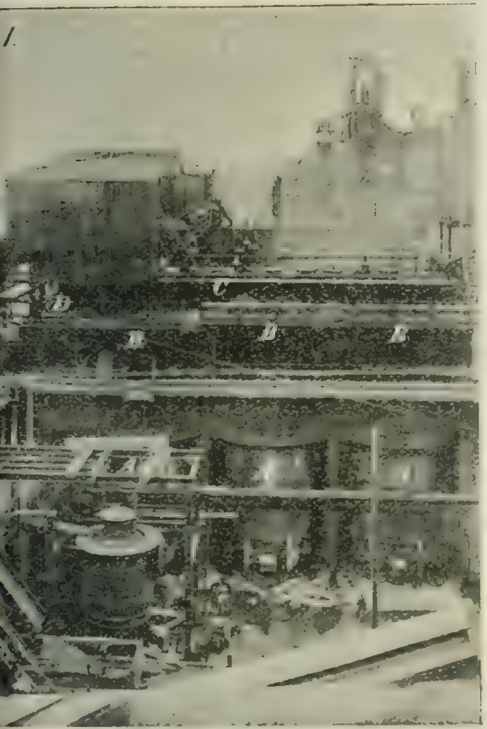
YOUNG AND BEILBY'S GAS PRODUCER, 1883.

(J. Soc. Arts, Feb. 23, 1883.)

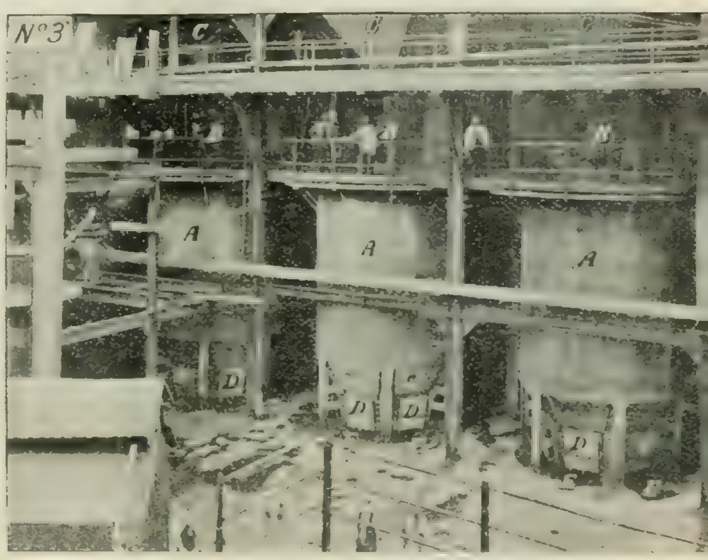


MOND GAS PRODUCER (Humphrey, Proc. Inst. C.E., cxxix, Session 1896–97, Part III.)

MOND GAS PRODUCERS—*continued.*

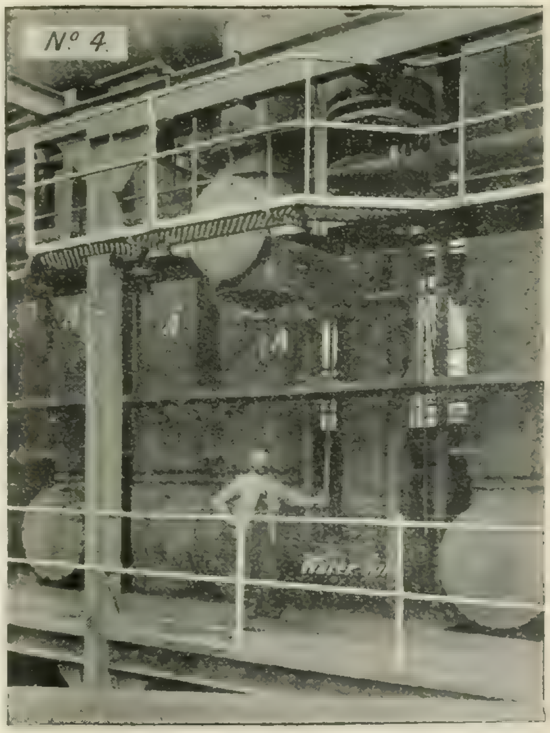


1.—Elevation of three Mond Gas Producers (A A A),
g slack elevator (D), creeper (C), and storage hoppers
), and ash-withdrawing hole.

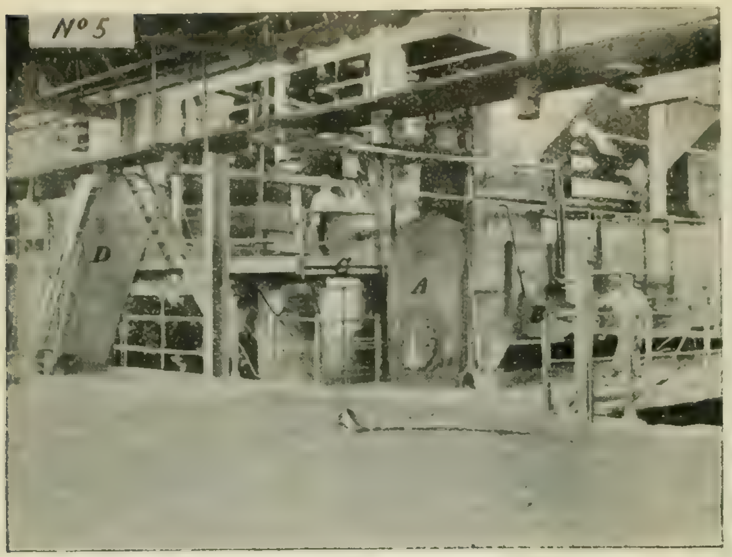


No. 3.—Three Mond Gas Producers (A A A), showing bottom of slack stock hoppe
(C C C), charging hoppers (B B B), body of producer, doors to get at bars (D), a
water lute to ashpits (E), for withdrawing ashes without stopping producer.

No. 2.—Elevation of Acid Tower for NH_3 recovery (B), gas cooler
C), and air-heating tower (D). The Mond producer (A) seen here
is the same one seen on No. 1.



No. 4.—Récuperator pipes for Mond Gas Producer (A A A).



No. 5.—Showing end of Mechanical Washer (A) with gas-inlet pipe, water lute, and dust-drawing box (B). Also slack elevator (D) and top of Mond producer (C).

Journal and Patent* Literature.

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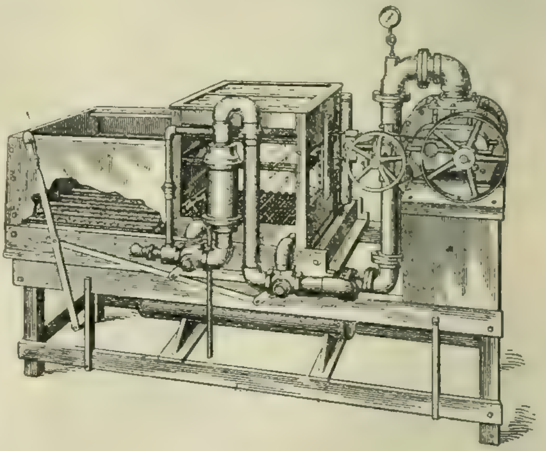
I.—PLANT, APPARATUS, AND MACHINERY.

Acid Blast Process for Etching. L. E. Levy. Journ. Franklin Inst. 147, [5], 337—344.

The apparatus is represented in the accompanying diagram. The etching-box, with glass sides and top, but without bottom, is placed in the tank of acid, which contains a series of tubes connected with the air-compressor, and ending in a large number of "atomising nozzles" above the surface of the liquid. The plate is prepared for etching in the usual way, and is clamped against a board, which is then slid into a moveable frame in the etching box. This frame is connected with an eccentric on the shaft of the compressor, so as to give it a reciprocating motion through a space equal to the distance between two rows of the nozzles below. When the air is turned on, the acid is blown in fine spray with considerable velocity perpendicularly against the plate, and does its etching work very rapidly; while the cooling effect of the expansion of the air prevents the temperature rising (as through the rapidity of the action it might otherwise do) to such an extent as to endanger the protective coating on the plate. The bubbles of gas produced, and the metallic scum which in the ordinary process has to be brushed from the surface of the plate, are swept away by the blast, and the surface of the plate remains clean. When the etching is finished, the frame and plate are pushed into the other half of the apparatus, and the plate is thoroughly washed by a stream of water blown against it by the same air pressure, which can be diverted from the acid trough to the water trough by a simple arrangement of cocks.



The process is far more rapid than the ordinary hand process; there is practically no undercutting, and hence no need to take the usual laborious precautions against it; more delicate and more uniform work can be done; there is less waste of acid; and the operator can be completely protected from the evolved fumes.—J. T. D.

Semipermeable Membranes, Practical Use of. B. Moritz. Chem. Zeit. 1899, [37], 400.

See under XXIV., *page* 715.

PATENTS.

Drying Sugar, Grain, Cotton-Waste, and other Substances and Materials; Impts. in Apparatus for. T. Haley, Rockford, Illinois, and T. H. Kraft, Marshalltown, Iowa, both of U.S.A. Eng. Pat. 8232, April 6, 1898.

The apparatus comprises a rotary inclined drying cylinder in combination with a heating system, which consists substantially of chambers at each end of the cylinder, a circumferential and a central series of tubes connecting the chambers, an axial steam inlet-pipe passing through the cylinder, and a tube surrounding the larger portion of the steam pipe. The steam admitted through the inlet pipe circulates through the system of tubes and chambers, and effects the drying of the material, which is supplied by a suitable feed mechanism, and is agitated between the tubes by the rotation of the cylinder, until it is finally discharged from the lower end of the latter. The details of construction are minutely described in the specification.—R. A.

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* Any of these specifications may be obtained by post by remitting 8*d.*—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

Distillation, Evaporation, and Extraction of Liquids; Impts. relating to the. E. Theisen, Baden-Baden, Germany. Eng. Pat. 10,693, May 10, 1898.

The liquid is spread, preferably by centrifugal action, in a thin layer in a heated cone, and the vapours generated are lifted off by a knife-blade, the edge of which is fixed close above the liquid surface, "so as to sweep it." The vapours are carried away through a suitable channel adjoining the knife-blade. The discharge of the vapours may be promoted by producing, by centrifugal action or exhaustion, a vacuum in the discharge channels. In a special form of apparatus described, the liquid is raised within a rotating inner cone, so that it is subjected to a preparatory heating before it is delivered on to an outer fixed cone. A series of inclined knife-blades are provided on the outside of the revolving cone. Owing to the pressure of the vapours on its surface, the liquid has a spiral circling motion imparted to it, whereby it is spread out in a thin layer on the heating surface.—R. A.

Measuring Liquids (viz.), Spirits, Mineral and other Oils, Acids, Drugs, and the like; An Improved Method or Device for. E. J. Read, St. Albans, Herts. Eng. Pat. 18,617, Aug. 31, 1898.

This invention is for measuring spirits, inflammable oils, and the like, directly into bottles or other vessels, without the aid of funnels or other measures. It comprises a measuring chamber, having a liquid inlet and an outlet spout at its base, and a spring-controlled venting valve at its upper end. The valve is opened when filling or emptying the chamber, and a two-way cock, operated by rotating the chamber, controls the admission and discharge of the liquid. An independent float-valve is also provided, to close the vent passages when the chamber is filled.
—R. A.

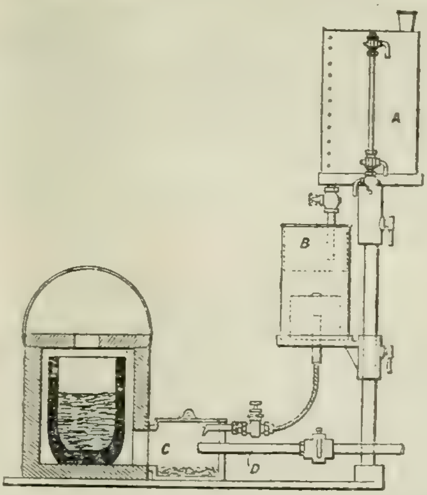
Filter Presses, Impts. in or relating to. M. Zahn, Artern, Thuringia, Germany. Eng. Pat. 6569, March 27, 1899.

The cakes deposited in the filter-press by the filtration of precipitates, &c., are uniformly compacted by subjecting them to the action of compressed air or gas, after which, if desired, they are washed by the application of a lixiviating liquid containing solid matter in suspension. The inner surfaces of the filter frames are tapered in the direction of the air inlet, so that the cakes are pressed by the action of the air into the narrower parts of the frames. For separating two or more substances contained in the liquid to be filtered, a lixiviating liquid is employed, consisting of a solvent of the body that is to be eliminated, having suspended in it solid particles of the substance which is to be retained in the press. The object of the invention is to prevent the formation of cracks or passages in the cakes, or between them and the frames, and so to ensure the thorough action of the washing liquid.—R. A.

II.—FUEL, GAS, AND LIGHT.

Furnace for Liquid Fuel. Eng. and Mining J. 1899, **67**, [16], 473.

The annexed figure shows the section of the furnace, primarily intended for brass-melting. The oil runs from the air-tight reservoir A into the vessel B, where it is maintained at constant level. It escapes from this through a filter to a tube provided with two regulating cocks (one not shown), and so to the combustion chamber C. Here it falls upon the end of the tube D, which is open at the extreme end and has a slot on the under side. Air is delivered through D, and causes the spraying of the oil as it drops over the slot. The flame from the oil and air plays around the crucible in the furnace and escapes through the hole in the cover, and this may be used to heat up another crucible. Two cocks are provided in the delivery tube of B so that one may be set to give the exact flow of oil required, while the other enables the supply to be shut off altogether and reopened at any time without readjustment, the oil being at constant level, and therefore discharged at uniform rate.
—W. G. M.



Carbides of the Metals of the Alkaline Earths, Bullier's Process for the Production of, Quashing of the German Patent 77,168 relating to. W. Borchers. Zeits. für Electrochemie, 1899, **5**, [48], 551—553.

The grounds of the decision of the Imperial Court on the application to quash this patent are quoted *in extenso*. The patentee claims a process for the production of compounds of carbon and the metals of the alkaline earths by heating a mixture of carbon and the oxides or carbonates of those metals in the electric furnace. Such a claim cannot be sustained, in the opinion of the Imperial Court, because, at the time of the application for the patent, if not earlier, it was well known that the carbides were formed when such a mixture was heated to a high temperature, and the use of the electric furnace for producing such a high temperature was known by Moissan and Willson. The appellants, however, asked only for protection for a process for producing crystalline calcium carbide of the formula C_2Ca by heating a mixture of about 36 parts of carbon and not less than 56 parts of calcium oxide in the electric furnace until it fused. This really implies not merely a limitation of the patent but a granting of a new patent, which is an inadmissible procedure. There is no doubt, however, from the specification that the defendant regarded the whole process as set forth in the claim as his invention, though such process was no invention. Neither did he claim a special modification of an existing process. The fusion of the mixture in the electric furnace was a condition previously known probably to Moissan and certainly to Willson, while the proportions necessary for the production of calcium carbide of the formula C_2Ca were also known, for Beilstein had formerly given that formula, and Maquenne had given the analogous formula for barium carbide. It was, however, shown that the invention of the defendant consisted in proving experimentally that the theoretical proportions were likewise right for practical working. But such is not a valid invention according to patent law, for no one can be hindered in applying the already established theoretical proportions for a mixture for the manufacture of the carbide. The invention did not pretend to have solved any practical difficulty in the application of the already known facts. The defendant likewise could not claim an invention on the ground that he was the first to produce the carbide in a crystalline form. The formula of the carbide had long been known, and it had been known that the carbide yielded acetylene. The discovery that, under certain conditions, the carbide was obtained in crystalline form did not constitute an invention for which a patent could be granted. It has frequently been observed that bodies obtained by fusion are crystalline when they have cooled undisturbed. In the case in question, the first production of crystalline as distinct from amorphous calcium carbide was not of great significance.

The author comments on the grounds of the finding of the court as summarised above. He expresses his conviction that Moissan did not earlier obtain fused calcium carbide, but only a fused mass containing the carbide. He states that Willson swore that calcium carbide was only known in the amorphous state prior to his patent of 18 Jan. 1895, and that Willson consequently had not recognised the importance of securing a dense crystalline product until some weeks after the appearance of Bullier's specification.—J. A. B.

The Automatic Ignition of Coal Gas. C. Killing. J. für Gasbeleucht. **42**, [18], 293—296.

Our present day "self-lighting bodies" are the outcome of Döbereiner's discovery that spongy platinum is capable of igniting a mixture of hydrogen with oxygen or atmospheric air. Coal gas, however, cannot be ignited by spongy platinum, even when the latter is incandescent. Max Rosenfeld discovered in 1888 that a warm Pt wire becomes incandescent when held at the point of commingling of air and coal gas; by combining one or more Pt wires with some spongy Pt, he invented the first "self-lighter" for coal gas. Spongy Pt soon loses its highly porous character if exposed much to the heat of the flame, but this depreciation is minimised by using a porous refractory support for the finely divided Pt. Duke dipped "pills" of asbestos or meerschaum into platinum chloride solution, dried them, and reduced the chloride to metallic Pt by means of reducing gases: these pills were used in combination with a Pt wire, on Rosenfeld's principle. Killing dissolved platinum chloride and thorium nitrate together, and by dipping into this a cotton fabric which had been woven with fine Pt wires, and then burning out the cotton, an effective body was obtained consisting of Pt wires intertwined with a mixture of thoria and platinum black. Butzke stitched such a body to the top of an incandescent mantle and in addition applied an "igniting line" of iridium from the top to the bottom of the mantle.

The action of these "self-lighters" depends on the power of platinum black to condense oxygen upon its surface, this oxygen attacking readily-oxidisable gases even at ordinary temperatures; the heat developed soon raises the body to a red heat. By placing platinum black in an oxidisable gas—even in ammonia or H_2S—its oxidising power is temporarily destroyed through consumption of its oxygen; but if it is placed in a non-reducing gas, such as CO_2, its oxidising power is not affected.

Spongy platinum, either alone or combined with a porous mineral support, becomes red-hot when in contact with coal gas, but cannot ignite it. As the heat is communicated to the Pt wire in contact with the sponge, the wire itself acquires an active oxidising property, the heat evolved being then so great as to raise the wire to a white heat and thus to ignite the gas. The observation is familiar to all that a *warmed* platinum capsule, if placed in a cold stream of coal gas, will rapidly become red-hot. Incandescent Pt has the power of condensing gases upon itself. In "self-lighting" bodies, therefore, the function of the spongy material is to start the oxidation process at the ordinary temperature, and, by transmitting heat to the wire, enable the latter to acquire the oxidising property with sufficient activity to raise itself to a white heat. The suggestion that the wire simply stores up the heat from the sponge, without itself becoming active, is manifestly absurd: if a fabric of fine Pt wire, with a "pill" attached, is held obliquely in a stream of gas until it begins to glow, and the pill is then clipped off, the wire continues to glow; but if the heat were stored up simply, the cold gas would quickly dissipate it.

With an igniting line of iridium on the mantle, the action is identical with that of the platinum wire. The temperature at the point of ignition is so high, that if some Pt black be placed there it is volatilised and condenses on the cooler parts of the mantle, and it is probable that the great irregularities observed in the durability of these iridium lines are due to the presence of varying amounts of platinum metals of lower melting points. The melting point of Pt is about 1,780° C.; that of Ir, 2,300°.

Simonini has devised a "self-lighter" in which the Pt wire or Ir line is replaced by a mixture of rare earths. As is well known, a mixture of thoria and ceria—say the incandescence mantle itself—when hot is capable of igniting coal gas. Simonini impregnates two fabrics and combines them so that one surrounds the other; after burning-off, the inner consists of a porous mixture of about 60 per cent. of Pt and 40 per cent. of ThO_2 or CeO_2, this mixture setting up the initial heating, while the outer material consists of about 92 per cent. of ThO_2, 4 per cent. of CeO_2, and 4 per cent. of Di_2O_3. When such a "self-lighter" is used, after the inner body has raised the whole to a certain temperature, the outer body acquires an active oxidising power, owing to the rapid alternate oxidation and de-oxidation of the cerium oxide, and the temperature rapidly rises to the ignition point of the gaseous mixture. To this action of the cerium oxide as an oxygen carrier and promoter of combustion, the author has previously ascribed the intense incandescence of mantles (see this Journal, 1896, 794, and 1898, 229.)
—H. B.

Hydrogen, The Flame of. Schlagdenhauffen and Pagel. Comptes Rend. 1899, **128**, [19], 1170—1172.

The authors conclude from their experiments that the flame of hydrogen, whether purified or not, becomes suddenly violet-blue, when it is pressed down by a cold body (glass or porcelain) under various conditions. This coloration is not due to the presence of hydrogen sulphide, as suggested by Salet, but to the presence of hydrogen selenide. The selenium is derived from the zinc used to prepare the hydrogen. It is evolved as seleniuretted hydrogen, but some is retained in the residue, probably as lead selenide, lead constituting the larger proportion of this residue.
—J. F. B.

Acetylene in Presence of Nickel, Hydrogenation of. P. Sabatier and J. B. Senderens. Comptes Rend. 1899, **128**, [19], 1173—1176.

When a mixture of acetylene and hydrogen gases is passed through a tube at the ordinary temperature, containing nickel freshly reduced from its oxide, combination takes place with rise of temperature. At first when the tube is cold, a proportion of 58 c.c. of hydrogen to 18 c.c. of acetylene gives a product consisting of approximately equal volumes of ethane and hydrogen. As the temperature rises, liquid hydrocarbons are produced in increasing proportions. When the ratio of hydrogen to acetylene is decreased to 2 or less, the amount of ethane decreases and increasing proportions of ethylene and unaltered acetylene are found in the product. The evolution of heat is greater as the proportion of hydrogen is lowered, and when acetylene alone is used, the mass becomes incandescent, and considerable quantities of liquid products are condensed. These liquid products consist for the most part of paraffins with smaller proportions of ethylenic and aromatic hydrocarbons. The nickel is almost unaltered by the reaction, a little carbon being fixed. Similar results are obtained with reduced iron, cobalt, and copper, at elevated temperatures.
—J. F. B.

Manganese, the Activity of, in exciting the Phosphorescence of Strontium Sulphide. J. R. Mourelo. Comptes Rend. **128**, [20], 1239—1241.

Manganese carbonate, added in small quantities to a mixture of strontium carbonate and sulphur, and heated to redness for some time, gives a substance which shows a pure green phosphorescence after exposure to diffused light; while neither the manganese salt, nor the mixture without it, is phosphorescent at all. Manganese carbonate seems to behave here exactly as bismuth subnitrate has been shown by the author to do. The best effects were obtained from mixtures of 100 grms. of strontium carbonate and 33 grms. of sulphur, to which was added 0·15 grm. of manganese carbonate, either alone, or with 1·4 grm. of sodium carbonate and 0·85 grm. of fused sodium chloride.
—J. T. D.

PATENTS.

Peat, [Fuel], Impts. relating to the Treatment of. E. Rischgitz, Bayswater, Middlesex. Eng. Pat. 11,799, May 24, 1898.

For making peat fuel, sufficient of solution of barium or strontium hydrate, or a mixture of the two, is added to disintegrated peat to bring it into a semi-plastic condition, when it is dried. For inferior peats, "a clear solution of carbonate of calcium, and carbonic acid and water" is used. In some cases, calcium hydrate mixed with "saccharine and water" is added for binding purposes. According to the fourth claim, "in some cases for the convenience of freely distributing the peat in a liquid state over the drying ground," besides strontium hydrate solution, there is added "a clear solution of hydrate of calcium in any quantity required."—E. S.

Drying [Peat, &c.], and to Apparatus therefor; Impts. in or relating to. S. Willson, Wembley, Middlesex. Eng. Pat. 12,440, June 2, 1898.

The apparatus comprises a rotary drying chamber of cylindrical form, preferably mounted at an inclination to the horizontal, and a series of curved vanes fixed to the internal wall of the cylinder, the vanes being adapted to agitate the material, and dispose it aslant a current of gas, by which it is dried. Beaters may also be provided for agitating the material. The drying chamber may be heated externally by a heating medium, which is subsequently passed through the chamber.—R. A.

Heating Apparatus, with Regulated Draught, for Drying Gypsum and certain other Products at a Regulated Temperature; A Special. H. K. Bamber, London. Eng. Pat. 5038, March 1, 1898.

The inventor claims "an apparatus for preparing plaster of Paris from original gypsum or plaster stone, or from previously used plaster of Paris, consisting of an oven, the interior of which can be kept within certain limits of temperature in the manner described, through which a current of hot air is caused to circulate." Also for the above purpose, "an oven provided with double walls, so as to contain petroleum or other fluid possessing a high boiling point," preferably about 500° or 600° F., "through which oven hot air is caused to circulate." The specification describes and shows how a current of air is induced through a pipe system passing through a fire beneath the oven, and is then passed into the oven through the door thereof.—R. S.

Gas-Fired Furnaces, Impts. in. F. J. Jones, Kenilworth. Eng. Pat. 11,101, May 16, 1898.

The inventor claims "in gas-fired furnaces the arrangement of retorts placed in a combustion chamber below the furnace bed, in which is burnt as much of the retort gases as is required to heat the retorts and furnace placed above the combustion chamber and connected therewith by flues or passages." Also, "in gas-fired furnaces, the arrangement of retorts in a combustion chamber below the furnace bed, the gases from which retorts are not consumed in the combustion chamber, but led away for other purposes." The procedure of charging and drawing the retorts is the same as in a gasworks, except that the period of distillation is lengthened to drive out all the hydrocarbons and to harden the coke.—R. S.

Smokeless Firing for Boiler Furnaces and the like, Impts. in or relating to. J. Gööz, Budapest. Eng. Pat. 12,254, May 31, 1898.

To increase the temperature of the heating gases and to intimately mix them with the air for secondary combustion, the flames are throttled as they pass, this being effected, in the case of internally-fired furnaces, by a prolonged high furnace bridge, and in the case of externally-fired furnaces, by an arch reaching nearly to the back wall of the fire space, in each case causing the entering gases to strike with increased speed on the surface of a second arch. The secondary air is led into a chamber arranged within the furnace bridge, the entrance of such air being governed by a valve operated from the outside, whilst the exit therefrom to the furnace is provided with a grating, beyond which the bridge is raised, so as to divert the fire gases from the grating. The valve supplying the air for secondary combustion, and the smoke damper are operated automatically by float mechanism, the water for which is shut off or let out by means of a valve operated from the outside. When the water overflows from the float cylinder it operates a small water-wheel, which rings a signal bell, calling the fireman to supply the grate with fresh fuel.—R. S.

Furnaces, Impts. in or relating to. M. Zahn, Artern, Thuringia. Eng. Pat. 6017, March 20, 1899.

This invention relates to feeding mechanically worked furnaces, and consists either in causing the fuel to travel through the combustion chamber in a direction opposite to that of the heated gases, or in causing the fuel to be heaped up towards the exit end, in order to prevent the undesired entry of air through the partly or wholly consumed residue of the fuel. Both these devices may be combined in one furnace. To cause this heaping up at the exit, several devices are described and claimed, namely, for travelling grates, (*a*) inclined plates above the fuel surface, (*b*) an upwardly-curved grate surface, and (*c*) a wedge-shaped projection forcing the fuel into deeper layers on each side; while for stationary grates the device may be (*a*) forwarding teeth passing between the bars of a horizontal grate, or (*b*) slides reciprocated between the bars of a stepped grate.—R. S.

Incandescence "Baskets," Impts. in. J. Imray, London. From J. Moeller, Paris and Westminster. Eng. Pat. 14,191, June 27, 1898.

Incandescence baskets of the Clamond type are made by squeezing a paste of magnesia, &c., through a die to form fine threads, and the object of this invention is to construct these threads of particles which are porous. An organic cellular material such as cotton or pith is impregnated with the solution of a salt of a refractory earth, the material is burned off at a low temperature, and the residue, in fine powder, is incorporated with a mixture consisting of organic agglutinating substance, such as starch, mixed with a solution of the salt of the refractory earth. The paste is squeezed through a die, the threads produced are woven into baskets, the baskets are heated in a closed chamber or a reducing medium and are then baked at a high temperature in an oxidising medium.—H. B.

Glow-Bodies for Incandescence Burners, Impts. in the Manufacture of. G. Kohl, Vienna. Eng. Pat. 15,957, June 21, 1898.

The process claimed consists in first impregnating a fabric with solution 1 given below, drying the fabric "at a high temperature," then impregnating with solution 2, drying and burning-off the fabric as usual. Solution 1 is prepared by dissolving in 1 kilo. of water—zinc nitrate, 2 grms.; tin nitrate, 1·2 grm.; bismuth nitrate, 1 grm.; borax, 1 grm.; calcium nitrate, 2 grms. Solution 2 is prepared by dissolving in 1 kilo. of water—thorium nitrate, 400 grms.; cerium nitrate (free from didymium), 2 grms.; barium nitrate, 0·4 grm.; strontium nitrate, 3·2 grms.; indium nitrate, 0·12 grm.; gallium nitrate, 0·04 grm.; and samarium nitrate, 0·24 grm.—H. B.

Burners for Incandescent Gas and Vapour Lighting, Impts. in and connected with. J. B. de Léry, New York. Eng. Pat. 19,167, Sept. 8, 1898.

Reference is made to Eng. Pats. 9940 of 1897, and 2365 of 1898. The present specification relates to suitable supports and burners for the tassel-like bodies described in the latter. A standard is provided with a number of radial arms having a substantial interval between each adjoining two, at the end of each arm is hung a removable tassel, and below the ring of tassels is fixed, concentrically, a burner having a perforated head, whereby the ring-shaped series of flames plays upon and round about the lower parts of the tassels, which thus become incandescent. There are three claims for combinations of parts.—H. B.

Automatic Gas and Vapour Igniters, A New or Improved Process for the Production of. A. Müller and O. Gareis, Berlin. Eng. Pat. 22,277, Oct. 22, 1898.

This specification refers to igniting-pellets to be used in conjunction with incandescence mantles. The first claim is for "the new or improved process for the production of automatic igniters (with the use of finely divided platinum, palladium, or similar metal) the feature of which is that the organic tissue of any kind serving for the production of the igniting body beyond being steeped in the solution of the platinum metal is also steeped with the solution of an aluminium and (or) beryllium metal, or with the solution of another metal having a close relationship to aluminium, and then glowed." The pellets are suspended from platinum wires, and instead of being attached to the mantle they may be hung inside the chimney or allowed to hang from the top of the mantle support, so that in case of renewal of the mantle, the igniters can be used again.—H. B.

Regenerative Gas Burners, Impts. connected with. D. C. Maturin, London. Eng. Pat. 2371, Feb. 2, 1899.

Burners are described, having ring-shaped flames, of the Argand or other types, each burner being surrounded by two chimneys with the object of heating the air supply. The gas supply also receives a preliminary heating by being led up and then down a pipe situated within the ring of flame; or the pipe may pass up and bend over in ring-shape above the top of the flame; or it may be arranged outside the inner chimney, the ring-shaped bend being situated on a level with the hottest part of the flame.—H. B.

Incandescent Lamp Burners for Petroleum and other Liquid Combustibles, Impts. in. A. Lenner, Vienna. Eng. Pat. 3577, Feb. 17, 1899.

This refers to a circular-wick lamp. The outer wick-tube is surrounded by a tubular casing of such a form that the sectional area of the air-passage between the two is uniform throughout; that is, the walls of the casing and the burner-tube are parallel. The casing has an inward bend or flange at the top. The flame-spreader consists of two concentric discs, one above the other, the lower one being perforated to allow the air current to pass up through it, the actual spreading of the flame being accomplished by the upper disc. There are five claims for details and combinations. —H. B.

Incandescent Spirit Lamps, Impts. in. K. Lehmann, Wilmersdorf, Germany. Eng. Pat. 6062, March 20, 1899.

A lamp is described and claimed with a circular wick, a central air-supply tube, and a flame spreader.—H. B.

[Incandescence] Gas Burners, Impts. in or relating to. C. Boulot, Brussels. Eng. Pat. 7644, April 11, 1899.

This relates to incandescence gas burners suitable for use without chimneys. The burner described consists of a burner tube covered at its upper end with metallic gauze, and closed at its lower end by a perforated plate, a tube of smaller diameter, provided at its lower end with a gas-inlet nozzle and lateral air orifices, being introduced through the perforated plate at the bottom of the larger tube so as to form an annular chamber between the two tubes. Air inlets are provided in the perforated plate and in the lower part of the larger tube, and bells are fitted on the two tubes so as to extend downwards beyond the air orifices, to protect them from draughts.—H. B.

Acetylene Generator, An Improved. S. de Szepczynski, Vienna. Eng. Pat. 3551, Feb. 17, 1899.

Above a water receptacle is placed a carbide drum surrounded by one or more annular receptacles; both drum and receptacles being divided into compartments, each of which contains a charge of carbide. The descent of the gasholder into which the gas passes, moves forward the drum, so that the contents of the compartments are discharged in turn into the water receptacle. Each annular receptacle is carried forward by the receptacle lying next to it only when the latter is emptied.—J. A. B.

Acetylene, Impts. in the Method of and Apparatus for Generating. B. Fröhlich, Reudnitz, near Leipzig. Eng. Pat. 5614, March 15, 1899.

A vessel contains a layer of chloroform, carbon bisulphide, or other inactive liquid, below a layer of water, and a carbide receptacle resting on a spring in an extension of the bottom of the vessel is in contact with the water when the pressure above the liquids is low, but in contact with the inactive liquid when the pressure is high.—J. A. B.

Acetylene Gas, An Improved Self-clearing Burner for. C. L. Lauri, London. Eng. Pat. 9226, April 21, 1898.

A wire mounted within the burner tip enters and clears the gas orifice of the burner when the tip or a milled head is screwed in one direction.—J. A. B.

Acetylene Gas, Impts. in or relating to Apparatus for Producing and Burning. M. Strakosch and F. Schmid, both of Vienna. Eng. Pat. 9718, April 27, 1898.

Ehe generator contains a vessel or vessels for the reception of closed cartridges containing calcium carbide. A perforator is thrust from outside the vessel through the cartridge when it is wished to bring the carbide in contact with water. Devices for cleansing the orifices of acetylene burners, consisting of a needle or blade, contained within or without the burner tube, for insertion in the orifice, are described.—J. A. B.

Acetylene Gas, Impts. in or relating to the Burning of. F. Windham, London. Eng. Pat. 10,815, May 11, 1898.

A cap, with an orifice about four times the area of the nozzle on the supply-pipe, forms a chamber above the nozzle, into which air enters through suitable orifices. The mixture of gas and air burns at the orifice in the cap. Ring burners on the same principle and a heating burner having two superimposed caps are also described.—J. A. B.

Acetylene Gas, Impts. in Apparatus for Generating and Purifying. J. Shackleton, Larne, and A. Ross, Ballyclare, Ireland. Eng. Pat. 11,367, May 18, 1898.

A bell floating in a tank of water has on its crown a hollow cock, the cavity of which is filled with carbide, which is discharged into the water in the tank when the cock is rotated. A grating near the bottom of the bell supports the carbide, which is discharged from the hollow cock, until it is decomposed.—J. A. B.

Acetylene Lamps, Impts. in. F. M. Rogers, London. From Sir C. S. Forbes, Strathdon, N.B. Eng. Pat. 11,716, May 24, 1898.

Water is supplied from a cistern through a dripping device in the side of a vertical tube to carbide in a generating chamber, and the gas evolved passes into a gas chamber and the burner. The dripping tube is designed to cause the water to flow in small drops on to the carbide, and thus induce an uniform production of gas.—J. A. B.

Acetylene or the like, Impts. in Apparatus for the Manufacture of. T. R. Fowler, Seacombe, Cheshire. Eng. Pat. 11,377, May 19, 1898.

The improvements are on apparatus such as that described in Eng. Pat. 14,742 of 1897 (this Journal, 1898, 653). The bell in its descent seals up and compresses a volume of air, confined over water, some of which is forced as the pressure rises into one of two generators, which operate in turn. The inlet and outlet cocks of the pair of generators are interlocked, so that when one generator is in action the other is automatically shut out. The control of the feed of water to the generator by means of the air chamber is stated to be superior to feed devices which act by the opening of cocks or valves.—J. A. B.

Acetylene Gas, An Improved Lamp or Lantern for Burning. S. Falk, London. Eng. Pat. 12,012, May 26, 1898.

A number of burners within a globe are supplied with air from above through the annular space between an inner tube, by which the products of combustion escape, and an outer concentric tube. A deflector prevents air currents directly entering the globe, and a reflector is placed above the burners.—J. A. B.

Acetylene Generator, An Improved. W. P. Thompson, London. From The Gesellschaft für Heiz- und Beleuchtungswesen, Heilbronn, Germany. Eng. Pat. 12,250, May 31, 1898.

Cylindrical or spherical cartridges of carbide are released in turn by a stop which is raised when the bell of the gasholder falls, and run forward down an inclined plane into a generating vessel containing water, whence the evolved gas passes into and raises the bell of the gasholder.—J. A. B.

Acetylene Gas, Impts. in or relating to Apparatus for the Generation of. J. E. Scarth, Pudsey, Yorks. Eng. Pat. 12,401, June 2, 1898.

Water is supplied from the tank of a bell gasholder through a pipe, the end of which is normally sealed in a mercury seal carried on a float, to a generator containing carbide, whenever the bell descends to a given point, and by depressing the float unseals the end of the pipe. The gas from the generator passes through a water seal to the gasholder, and raises the bell until the float is again free to rise and effect the sealing of the pipe, thereby cutting off the supply of water to the generator. Two or more generators may be used successively by the aid of suitable connections.—J. A. B.

Acetylene Generators, Impts. in or relating to. E. L. Levetus, Birmingham. Eng. Pat. 12,469, June 3, 1898.

Water is supplied from a tank above or surrounding a carbide receptacle to the carbide therein by means of a siphon provided with a cock and a contracted orifice or small perforations. A pipe with safety valve allows the escape of "aftermake" if it occurs.—J. A. B.

Acetylene Gas, Impts. in and relating to Apparatus for Generating. F. A. Jackson, Tonbridge. Eng. Pat. 13,029, June 10, 1898.

A disc, carrying carbide containers, is placed in an upright position above a shoot which leads on to a strainer within a water-tank, above which is the bell of a gasholder. The bell, into which the generated gas passes, operates in its descent a ratchet and pawl device by means of which the disc is rotated, so that at each descent of the bell, one container discharges its contents of carbide into the shoot leading to the water tank.—J. A. B.

Acetylene Gas-Lamp, An Improved Portable. La Société Chaussard et Cie., Courbevoie, and C. E. Vignes, Orsay, both in France. Eng. Pat. 13,573, June 17, 1898. [Under Internat. Convention.]

An ovoid receiver is charged with olive-sized fragments of carbide, and some saccharose, and is supported so that its lower end, which is provided with an opening with blades, dips into a solution of saccharose. The water of the solution acts on the carbide and the gas evolved depresses the level of the solution below the mouth of the receiver. The saccharose dissolves the lime formed and removes it from the receiver. A flexible pipe conveys the gas from a bell above the receiver through gauze to the burner. Signals are given by sounding blades of the movements of the bell.—J. A. B.

Acetylene Gas, Improved Apparatus for the Generation and Supply of. Sir C. S. Forbes, Strathdon, N.B. Eng. Pat. 13,070, June 11, 1898.

A drawer, which may be divided into compartments, contains carbide and is placed in a water-jacketted chamber beneath a water tank. A pipe passes up through the water tank from the top of the carbide chamber, and is encased by a gas vessel. The level of water in this vessel is controlled by the pressure of the gas. When the pressure of gas falls, the water rises, and at a certain point, flows through an orifice in the pipe to a nozzle from which it drips on to the carbide in the chamber beneath, and generates acetylene. A rise of pressure in the gas vessel owing to cessation or diminution of consumption depresses the level of the water below the drip orifice, and thus cuts off the supply to the carbide.—J. A. B.

Acetylene Generators, Impts. in or applicable to. Sir C. S. Forbes, Strathdon, N.B. Eng. Pat. 13,636, June 18, 1898.

Water gains access from a tank to a generating chamber containing carbide through a dripping nozzle such as is described in Eng. Pat. 13,070 of 1898 (see previous abstract). The dripping nozzle is at a part of the gas and dripping tube which is cone-shaped externally, and on the cone fits a collar attached to the gas pressure vessel. Rotation of the collar brings a perforation in it more or less coincident with the perforation in the dripping nozzle, and thus controls the amount of water delivered through the latter. A bayonet joint prevents the collar being lifted from the cone by the gas pressure.—J. A. B.

Acetylene Lamps, Impts. in or applicable to. Sir C. S. Forbes, Strathdon, N.B. Eng. Pat. 13,968, June 23, 1898.

In a cistern above a generating chamber is placed a bell, the top of which screws into the top of the cistern and carries the burner. A conical valve above a dripping nozzle is opened more or less by rotation of the bell, and the supply of water to the carbide is thus regulated. When gas accumulates in the bell, the water therein is forced below the level of the orifice of the valve, and the supply of water to the carbide is thus completely cut off until the accumulation of gas has been disposed of.—J. A. B.

Acetylene Gas, Impts. in Apparatus Connected with the Manufacture of. Sir C. S. Forbes, Strathdon, N.B. Eng. Pat. 14,139, June 25, 1898.

The gas from a generator passes down a cooling coil immersed in water, and then through a seal, with overflow at a constant level, to the gasholder.—J. A. B.

Acetylene Gas Lamps, An Improved Generator for. F. B. Parkinson, Cheltenham. Eng. Pat. 14,144, June 27, 1898.

Carbide is fed from a storage vessel into a tank containing water by means of an archimedian screw, which is rotated through a clutch by the spindle of the gas meter, through which the gas evolved passes after it leaves a governing chamber. This chamber has a flexible top, the distension of which by the pressure of the gas actuates levers operating a brake on the spindle of the meter, thereby diminishing the speed of rotation of the feeding screw as the gas pressure rises. The rotation of the screw may be stopped by an external handle, and the generation of gas thus discontinued.—J. A. B.

Acetylene Gas, Impts. in Generating. E. Delmouly, Paris. Eng. Pat. 15,179, July 11, 1898. [Under Internat. Convention.]

Water passes from a reservoir through a pipe packed with a wick to the annular space between this pipe and an outer one. The latter is perforated at a certain height, and the water passing through the holes decomposes carbide in an outer receptacle. When the pressure of gas in the latter rises, it forces the water in the annular space below the level of the holes, and thus hinders the generation of gas until the pressure falls.—J. A. B.

Acetylene Gas Generators, Impts. in. M. Bohne, Berlin. Eng. Pat. 15,423, July 13, 1898.

Carbide falls from a hopper, mounted on a bell floating in a tank of water, into the latter whenever a weighted rod touches the bottom of the tank owing to the descent of the bell. The rod actuates a rocking device by which the carbide is discharged from the hopper according to the movements of the bell. The gas evolved passes through the store of carbide in the hopper to a pipe which leads to an annular gas storage space around the inner bell. A layer of petroleum covers the water in this space, and prevents the gas, which has been dried by passage through the carbide hopper, coming in contact with water.—J. A. B.

Carbide Cartridges, Impts. relating to. B. H. Wallin and R. de Wendel, both of Gothenburg, Sweden. Eng. Pat. 20,057, Sept. 21, 1898.

Cylinders of unsized porous paper are filled with finely divided calcium carbide, and the ends are folded up or closed by lids. The grade of porosity of the paper is such that the evolution of gas is completed within one minute of the immersion of the cartridge in water.—J. A. B.

Acetylene and Similar Gas, Impts. relating to Burners for. A. J. Boult, London. From H. E. Shaffer, Rochester, N.Y., U.S.A. Eng. Pat. 1634, Jan. 24, 1899.

The gas passage of the burner is bifurcated, and each bifurcation bends up at right angles, so that the two streams of gas issuing from the burner tips meet and burn between the latter. Beneath the tips and between the two arms of the burner is a hollow extension with taper top, which becomes heated by the flame and radiates heat to it. The burner tips may have lateral air-supply orifices.
—J. A. B.

Acetylene Generators, Impts. in. A. Combier, Pierre Bénite, France. Eng. Pat. 6925, March 30, 1899.

Carbide is discharged from a hopper mounted on a bell, floating in an annular seal around a central tank containing water, into the latter whenever the bell falls below a certain point. The hopper is closed by a ball valve, protected by a hood from the weight of the superincumbent carbide. The valve is lifted from its seat, when the bell falls, by a rod. On the continued fall of the bell, the orifice of the hopper is closed by a second ball valve. The valves are set at such a distance apart that the quantity of carbide discharged at each fall of the bell is sufficient to provide a full charge of gas.—J. A. B.

Acetylene, Apparatus for Generating. C. Demuth, Zittau, Saxony. Eng. Pat. 7877, April 14, 1899.

The generator, placed alongside a bell gasholder, comprises a water tank, into which carbide is discharged in turn from each compartment of a drum mounted above the tank. The drum is loaded with a weight which causes it to rotate through a distance determined by the length of each of a series of slots into and out of which stops are caused to move by means of a two-armed lever, which is actuated by an arm attached to the bell of the gasholder, according to the rise and fall of the bell. When the bell descends, the drum is rotated so far that one compartment discharges its carbide on to a cone which deflects it to the sides of the tank. The generated gas passes into the gasholder.
—J. A. B.

Electrical Furnaces, more particularly applicable for the Production of Calcium Carbide, Impts. in and relating to. W. L. Durban, London; and John Gore, Trowbridge, Wilts. Eng. Pat. 14,132, June 25, 1898.

The claims are for combinations of parts in that construction of electrical furnaces for the production of calcium carbide, and for other purposes, in which the necessary heat is produced by the incandescence of a carbon conductor held between the ends of two electrodes (terminals), to which electrical energy is supplied from any suitable source.
—J. C. R.

Electrical Furnace with Peripheral Heating by Means of Electrical Resistances. D. Lance, R. L. E. de Bourgade, and L. Schmitz, all of Paris. Eng. Pat. 6582, 1899. [Under Internat. Convention (France), Aug. 29, 1898.]

"An electrical furnace consisting of a chamber preferably of annular form, one part of which constitutes the supply compartment for the gases to be treated, and which contains pieces of porcelain, or other suitable material for subdividing and uniformly distributing the gas supply, while another part of the chamber constitutes the reaction compartment, which is charged with material on which the said gases are to react, and which is heated over its entire external periphery by means of a series of resistance conductors through which an electric current is made to pass in such manner that the entire current passes successively through each of the conductors, substantially as herein described with reference to the drawing." [See abstract below.]
—J. C. R.

Electrical Furnaces, Impts. in. D. Lance, R. L. E. de Bourgade and L. Schmitz, all of Paris. Eng. Pat. 8060, April 17, 1899.

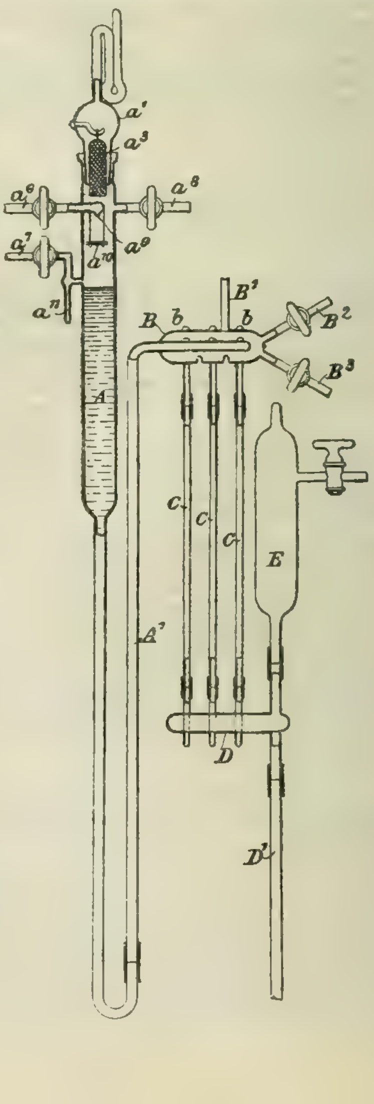
These are improvements on the previous patent 6582 of 1899 (see above), and relate to methods of obtaining a higher and more uniform temperature at all points of the furnace, "which is necessary for certain operations, and especially for the manufacture of cyanides by the process based on the employment of hydrogen, nitrogen, ammonia, and carbon:" and means for preventing loss of heat due to radiation.

1. "In an electrical furnace heated externally by means of conductors constituting resistances, the use, for the heating conductors, of two helically coiled wires or bands connected with the source of electrical energy, and arranged close to the furnace walls . . ."

2. "In an electrical furnace, &c., the use of jackets or casings of a bad conductor of heat enclosing those walls that are not situated near to a heated wall belonging either to the same furnace or to a different one . . ."—J. C. R.

High Vacuum [in Incandescent Electric Lamps, &c.], An Improved Method of and Apparatus for Obtaining a. H. S. Maxim, London. Eng. Pat. 4738, Feb. 25, 1898.

The method employed consists in the combined use of a mercurial pump, on the Sprengel principle, with a mechanical



pump. The mercury is admitted to the head A of the pump through a nozzle a^6, which discharges it through the jet a^9 on to the plate a^{10}. In this way, the mercury is comminuted, and any contained air or moisture is withdrawn by the mechanical pump, which is connected to the nozzle a^8. A hygroscopic material may also be enclosed in a cage a^3 in the head. A third nozzle a^7 is connected to the mercury reservoir and to the head A, the fall pipe a^{11} serving in conjunction with this nozzle, to withdraw accumulated air from the head. From the head A the mercury passes through the pipe A^1, and is discharged through vertical jets into the recesses *b* in the upper chamber B, from which it falls, in large, tightly-fitting drops, into the fall tubes C, and descends, with the entrapped air, through these tubes into the lower chamber D. The air passes into the chamber E, from which it is withdrawn by the mechanical pump, while the mercury passes away through the pipe D^1 into a reservoir, from which it is raised by an elevator of special construction, into the feed reservoir. The chamber B is connected to the mechanical pump by the nozzle B^2, and is provided with a pipe B^1, to which the lamp bulbs, &c. are attached. After exhaustion, acetylene or other suitable gas is admitted to the bulb through the cock B^3, and the bulb is again exhausted. The mechanical pump has three cylinders working in series. The first two pumps of the series each have conical suction and discharge valves, which are operated by spring-controlled levers supported by the valves, the pivots acting alternately as fulcrums for the levers. Several modifications of details are also described.—R. A.

Incandescent Arc Electric Lamps [*Refractory Oxides*], *Impts. in.* W. E. Irish, Cleveland, Ohio, U.S.A. Eng. Pat. 27,074, Dec. 22, 1898.

Highly refractory oxides are employed, such as zirconium, thorium, magnesium, calcium, as cores or filling of much less conductivity than the carbons, but become conductive when under the heating effects of the arc to which they are directly exposed. The inventor states: "I believe myself to be the first to substitute in a lamp an incandescent medium for the arc, the arc itself contributing to heat the medium to conductivity and thereby extinguishing itself while the current flows through the medium."—J. C. R.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

PATENTS.

Liquids [*Mineral Oils*], *Impts. in the Method of and Apparatus for Distilling.* L. C. Reese, London. Eng. Pat. 12,181, May 28, 1898.

The method involves the use of a chamber for vaporising the liquid to be distilled, the chamber being uniformly heated from all its sides to the desired temperature and the liquid being introduced under pressure through a distributor. The chamber has a free outlet for the vapour at its upper part and a trapped outlet for the residue at the bottom, and is adapted to effect the automatic uniform and continuous vaporisation of all the volatile constituents to be obtained from the liquid and the separation of the residue. The apparatus further comprises a fractionating plant consisting of a series of condensers, each surrounded by a cooling chamber, through which the vapour is continuously passed, each condenser, excepting the last one, being provided at its lower part with an upturned outlet pipe for the condensed liquid leading as regards the first fraction, to an ordinary cooler and as regards each subsequent fraction (excepting the last), to the cooling chamber of the next preceding condenser, so that the first condenser is cooled by the "re-boiled" fraction condensed in the second condenser, the latter is cooled by the "re-boiled" fraction condensed in the third condenser, and so on. The respective fractions coming from each of the condensers after serving the purpose of cooling the vapours, and while still hot, are led through suitably arranged outlet pipes to common coil condensers cooled by cold water.—D. B.

Tar, Oil, or the like, Impts. in and Apparatus for Distilling, and for Distilling or Concentrating other Liquid or Semi-liquid Matters. P. Tack, Brussels. Eng. Pat. 16,045, July 22, 1898.

The characteristic feature of this invention consists in the minute separation or division of the heated matter, so that it is spread over a wide surface in order to obtain a rapid and continuous supply of gases and vapours.

The apparatus comprises a column, into which the tar previously heated by exhaust steam is pumped, and which is traversed by a heater formed by a pipe containing steam from the boiler, one or more digesters in which the tar is reduced to a fine spray by a disperser or turbine, a fractionating column for each digester for receiving and separating the gases and vapours, a receptacle in which the tar after the removal of the lighter portions, such as ammoniacal liquor, carbolic oils, naphthalene, is again heated and divided into a spray for the purpose of separating creosote and anthracene oils, and horizontally superposed plates over which the residue or pitch flows in thin layers in alternating direction, being simultaneously exposed to the direct action of highly heated steam introduced below the plates. The hot liquid residue accumulating below the plates is conveyed into a mixing drum, wherein the adjustment of the pitch is effected by mixture with heavy tar oils.

A modified form of the apparatus comprises a system of double pipes for heating and re-heating the tar by steam, digesters and dispersers for the heated or re-heated tar, separate receiving and fractionating vessels for the separated or condensed products of distillation, and a mixing device for softening the pitch.—D. B.

Oils, Mineral, An Improved Apparatus for Gasifying. H. Parthon de Von, Soignies, Belgium. Eng. Pat. 6610, March 27, 1899.

The object of this invention is the production in a simple and economical manner of a large volume of gas from mineral oils.

The apparatus comprises a gasifying tube of metal, porcelain, or other refractory material, which is usually coiled and may be heated by any desired, convenient means. The inlet and outlet ends of the tube are provided with regulating valves for the purpose of maintaining the desired proportion between the supply of mineral oil and the discharge of the gas.—D. B.

Petroleum, Crude, and its Products; Impts. in Refining. R. Haddan, London. From F. Berg, Cleveland, Ohio, U.S.A. Eng. Pat. 7627, April 11, 1899.

The process consists in the treatment of the crude oil with an alkali in the proportion of about one gallon of the latter to one barrel of oil, and heating this mixture to a comparatively high temperature (about 200° F.) for a few hours, stirring the same during this time for about 10 minutes every hour. The oil is then separated from the alkali, and the impurities, which have been precipitated, after which the alkali still contained in the oil is allowed to continue its work for several days at a moderate temperature (about 70° F.). It is then subjected to distillation, and the resulting distillate treated slightly with sulphuric acid (about three pounds of acid to one barrel of distillate, or, if spent acid be used, about five pounds of the latter to one barrel of distillate) for the purpose of removing all traces of water in the oil. The latter is again treated with an alkali, subjected to a second distillation and the distillate finally washed lightly with sulphuric acid (about two pounds of fresh acid per barrel). The resulting product is said to be a clean, odourless oil, having superior illuminating properties.—D. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

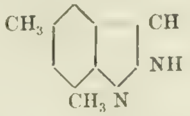
Sulphinic Acids by Means of the Diazo Reaction, Preparation of. L. Gattermann. Ber. **32**, [7], 1136—1159.

The subject-matter of this paper has already been described (Eng. Pat. 26,139 of 1896; this Journal, 1897, 907). The author decomposes diazo compounds in presence of

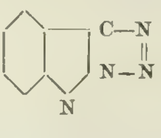
sulphurous acid with finely-divided copper, and obtains the corresponding sulphinic acids (see also Eng. Pat. 23,047 of 1897; this Journal, 1898, 916). These products, on reduction with zinc-dust and dilute sulphuric acid, give mercaptans, and, on oxidation with potassium permanganate in a potash solution, yield sulphonic acids, rendering it possible to obtain certain acids, especially in the naphthalene series, which otherwise could only be prepared with difficulty, or not at all. The paper contains a large number of examples giving the characteristics of the various compounds obtained.
—T. A. L.

Diazonium Salts, Action of Alkalis on o-Methylated. [*Indazines or Indazoles.*] E. Bamberger. Annalen, **305**, 289—370.

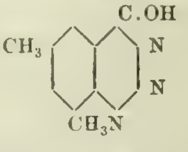
The author finds that the action of soda-lye on *o*-methylated diazo compounds, of which he has more particularly studied diazomesidine, produces, in this instance, two substances, one colourless, having the composition $C_9H_{10}N_2$, which is dimethylindazole—



whilst the other is orange-yellow, having the composition $C_{18}H_{20}N_4$, and is an azo-compound, which on reduction yields mesidine and an amidodimethylindazole, in which the amido group is attached to the carbon atom in the indazole ring. The latter compound on oxidation yields dimethyloxyphentriazine, and this reaction is characteristic of the amidoindazoles containing the amido group in the indazole ring. The orange-yellow product can also be obtained by combining diazomesidine with dimethylindazole, and a number of azo compounds from other diazo salts and dimethylindazole are referred to in the paper. The amidoindazoles described, possess in general the characteristics of aniline bases, but differ in giving, under certain conditions, stable free diazohydroxides, $R.N_2OH$, which combine as such with phenolates, giving different shades from those obtained by dissolving these substances in water by means of mineral acids or caustic alkalis. On dissolving these indazolediazohydroxides in dilute hydrochloric acid and adding potassium acetate, inner anhydrides are obtained, which the author terms indazoletriazolenes, an example of which is—



None of the author's amidoindazoles show the isonitrile reaction, whilst a delicate reaction for them depends upon the fact that they are reddened by air or by a trace of potassium ferricyanide in presence of alkalis. This coloration is due to the formation of well-crystallised, shining, greenish dyestuffs, which are primary (diazotisable) bases, recalling the eurhodines in the insolubility of their nitrates in water containing nitric acid. In addition to the products already referred to, dimethylindazole and mesitylazodimethylindazole, there are also obtained by the action of soda-lye on diazomesidine, mesitol, mesitylene, chloromesitylene, mesidine, mesitylenic acid, and two gums which have different solubilities in ether. The action of soda-lye on diazotised *o*-toluidine and on *m*-xylidine has also been investigated, yielding as chief products, in the former case, indazole and *o*-tolylazo-indazole, and in the latter, methylindazole and *m*-xylylazomethylindazole. The dimethylindazole from diazomesidine forms white, matted needles, melting at 134° C., and gives an acetyl compound melting at 117° C. Mesitylazodimethylindazole forms orange-yellow, matted needles melting at 258° C. It can be obtained by adding diazomesidine hydrochloride to a solution of dimethylindazole in dilute hydrochloric acid and running the mixture into well cooled soda-lye (the azo compound cannot be separated by means of carbonate or acetate). Phenylazodimethylindazole is obtained in the same way, and forms golden-yellow needles melting at 207° C., the substance possessing very faint acid properties. The mesitylazodimethylindazole, on reduction with stannous chloride, yields mesidine and amidodimethylindazole, which forms plates melting at 149° C. This product condenses with benzaldehyde to form benzylidene amidodimethylindazole, colourless needles or pyramids, melting at 184° C., a thiourea derivative crystallising in needles melting at 209° C., and a benzene sulphamide melting at 233° C. The diazo compound combined with β-naphthol forms reddish-brown, bronzy needles melting at 267° C., soluble with an indigo-blue colour in concentrated sulphuric acid, changing to yellowish-red on adding water, and to magenta on adding a crystal of nitre. The amido compound on oxidation gives dimethyloxyphentriazine



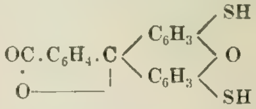
colourless needles melting at 220° C., which on warming with α-naphthylamine acetate gives a violet-red and also a red with fused resorcinol. Starting with 320 grms. of mesidine, the author isolated 14·25 grms. of amidodimethylindazol, melting at 149° C.; 6 grms. of dimethylindazol, melting at 133° C.; and recovered 29 grms. of mesidine. A similar series of reactions and compounds has been obtained from diazo-*o*-toluidine, and also from diazo-*m*-xylidine. The former gives an amidoindazol, melting at 154° C., which is very sensitive to caustic alkalis in presence of air, giving a dyestuff forming a sparingly soluble nitrate. The colour base crystallises in brownish-red, bronzy needles with a greenish reflex, and melts at 235° C. The corresponding colour base from *m*-xylidine also crystallises in tufts of shining red needles with a metallic greenish reflex.
—T. A. L.

Tetramethyldiamidodiphenylethane, Derivatives of. A. Trillat. Comptes Rend. **128**, [23], 1404—1406.

The unsymmetrical base, obtained by the condensation of acetaldehyde with dimethylaniline, readily forms derivatives. *Hydrochloride*, $C_{18}H_{24}N_2.2HCl$: obtained by evaporation of the solution of the base in hydrochloric acid; white crystalline powder, soluble in alcohol and in water, not in acetone; melts with decomposition at 225° C. *Sulphate*, $C_{18}H_{24}N_2.2SO_4H_2$: by evaporation of the solution of the base in dilute sulphuric acid, and recrystallisation from alcohol; colourless hygroscopic crystals, melting at 188°—189° C. *Phosphate, oxalate, tartrate, acetate*, all formed in a similar way; the last crystallises in long needles which redden in the air. *Nitrous acid* does not yield a nitrosoderivative, but gives a substance apparently identical with 1 : 4-nitrodimethylaniline.—J. T. D.

Thiofluoresceïn and some Phthaleïn Derivatives. L. Gattermann. Ber. **32**, [7], 1127—1135.

Although fluoresceïn chloride cannot be reconverted into fluoresceïn either by heating or even fusing with potash, both chlorine atoms can be readily substituted by the SH group or by thiophenol radicles by simply heating on the water-bath. On heating 5 grms. of finely powdered fluoresceïn chloride with 50 c.c. of freshly prepared alcoholic potassium sulphhydrate (by saturating concentrated alcoholic potash with sulphuretted hydrogen) on the water-bath, the solution deposits potassium chloride and turns blue. After filtering, thiofluoresceïn,—



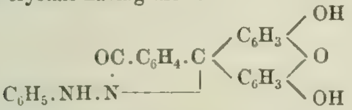
is deposited on adding dilute acid. The substance forms a greyish-white amorphous powder which does not melt at 300° C. It dissolves in alkalis with a blue colour which is destroyed on oxidation or by heating with zinc dust. In the latter case the leuco compound on standing is reoxidised and turns blue, but the colour is not so dark as the original. If fluoresceïn chloride be heated under an inverted condenser with an equal weight of thiophenol and half its weight of potash in an alcoholic solution for half an hour, a colourless precipitate of the phenyl ester of thiofluoresceïn is obtained on adding water. When crystallised from glacial acetic acid the substance forms colourless needles melting at 198° C. The *o*-tolyl ester obtained similarly forms colourless prisms melting at 201° C. By acting with thioguaiacol (from *o*-anisidine) on fluoresceïn chloride in a similar manner, the corresponding ester is obtained melting at 213° C., and this when treated with bromine gives a greenish metallic powder dissolving in chloroform with an Eosin red colour, but unstable and decomposed on adding water. Thioguaiethol (from *o*-phenetidine) also gives an ester melting at 187° C., and in like manner forms an unstable bromine product. Methoxythiocresol—

$$(CH_3:SH:OCH_3,\ 1:3:4)$$

when condensed with fluoresceïn chloride in the same way gives an ester melting at 145° C.

According to a French patent specification, the action of alkaline sulphides on dinitrophenolphthaleïn gives a dyestuff having blue alkali salts. In the expectation that in this reaction the nitro group had been replaced by the SH group, the author examined the action of potassium sulphhydrate on dinitrophenolphthaleïn, but found that the product was merely reduced thereby, forming diamidophenolphthaleïn.

The author has also examined the action of phenylhydrazine on certain phthaleïns. When boiled with fluoresceïn, the phenylhydrazide of this compound is obtained in colourless crystals having the formula—



$$\begin{array}{l} OC.C_6H_4.C\Big\langle \begin{array}{l} C_6H_3\langle OH \\ \quad\ \ \ \rangle O \\ C_6H_3\langle OH \end{array} \\ C_6H_5.NH.N\text{———}| \end{array}$$

The substance is sparingly soluble in ether, and dissolves to a colourless fluorescent solution in alkalis. Fluoresceïn chloride gives a similar compound melting at 265° C. and insoluble in alkalis. Phenolphthaleïn also gives a phenylhydrazide. All these hydrazides on heating with alkylhalogens yield colourless esters. For example, fluoresceïn phenylhydrazide gives a dimethyl ester crystallising in silky needles melting at 228° C.; the diethyl ester melts at 248° C., whilst the corresponding esters of phenolphthaleïn phenylhydrazide melt at 228° C. and 242° C. respectively. On heating with hydrochloric acid under pressure, these esters yield the dialkyl esters of fluoresceïn and phenolphthaleïn. On heating fluoresceïn phenylhydrazide with concentrated hydrochloric acid under pressure, a deposit of shining red plates was observed. This product is a molecular addition product of fluoresceïn and hydrochloric acid analogous to a compound obtained by von Baeyer by heating fluoresceïn with sulphuric acid. Both these compounds are decomposed by alkalis into the acid and fluoresceïn.—T. A. L.

Substituted Diphenylanthrones. L. Tétry. Comptes Rend. **128**, [23], 1406—1407.

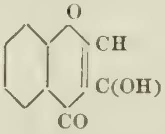
Haller and Guyot prepared diphenylanthrone by acting on phenyloxanthranol chloride with benzene in presence of aluminium chloride. By this process, using, in place of benzene, anisol, phenetol, dimethylaniline, and diethylaniline respectively the author has prepared methoxy-, ethoxy-, dimethylamido-, and diethylamido-diphenylanthrone. The two latter compounds are but feebly yellow, while the corresponding dimethylamido- and diethylamido-anthraquinone are red. Diphenylanthrone, then, with one CO group, is a feebler chromogen than anthraquinone, with two CO groups.—J. T. D.

Digitoflavone, A New Substance from Digitalis Purpurea. F. Fleischer. Ber. **32**, [8], 1184—1190.

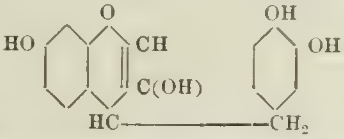
Together with digitoxine, a crystalline substance which the author terms digitoflavone, can be extracted from *digitalis* leaves. The product is of a yellow colour and separates from 70 per cent. alcohol in crystals containing water of crystallisation ($C_{15}H_{10}O_6H_2O$) which they lose completely at 150° C. It is not volatile, and when quickly heated it melts at about 320° C. On shaking with benzoyl chloride and soda-lye, or by heating with benzoic anhydride, a tribenzoate is obtained which can be precipitated from its solution in chloroform by adding alcohol. It then forms small colourless needles, melting at 219° C. The triacetyl derivative melts at 222° C., and the tribenzene sulphonate, $C_{15}H_7O_6(C_6H_5SO_2)_3$, crystallises from chloroform-ether in white needles melting at 189° C. The substance, in its properties, bears a general resemblance to the flavones or phenylpheno-γ-pyrones, such as chrysin, luteolin, fisetin, quercetin, morin, and myricetin, and since a test by Zeisel's method showed the absence of a methoxyl group, the substance was heated with caustic potash to 170° C., when it yielded phloroglucinol, and most probably protocatechuic acid. On heating with concentrated hydrochloric acid to 350° C., one of the products obtained was pyrocatechol, which, in the author's opinion, is derived from a different part of the molecule from that yielding the pyroglucinol and pyrocatechuic acid. Sufficient evidence has not yet been accumulated to enable a formula for the compound to be constructed with certainty beyond that it has the structure of a flavone and contains three hydroxyl groups. The subject is to be further investigated.—T. A. L.

Brasilin. W. Feuerstein and St. v. Kostanecki. Ber. **32**, [7], 1024—1030.

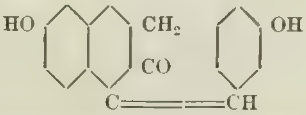
According to Schall and Dralle (Ber. **21**, 3009) an alkaline solution of brasilin on oxidation yields a product having the formula $C_9H_6O_4$. This, as Schall pointed out (Ber. **27**, 528), might be 3.oxypheno-γ-pyronol,



and the authors have investigated the action of sodium alcoholate on the dimethyl ether of this oxidation product. They obtain as products of the reaction formic acid and fisetol dimethyl ether (Ber. **28**, 2303) and suggest the following as a tentative formula for brasilin—



A substance having this constitution, on losing 2 hydrogens, would give a quinonoid formula for brasileïn accounting for the red colour of its lakes. It is, however, also possible, that brasileïn has the formula—



and the following reasons are given in support of the view that this represents a red dyestuff.

It has been shown that those monohydroxylated chromogens are darkest coloured which contain the hydroxyl nearest to the chromophor, and in dyestuffs not containing nitrogen, not only must hydroxyl be considered as an auxochromic group, but the methylene group also possesses a similar function. The formula given for brasileïn is certainly that of an orange dyestuff, since it contains the chromophor CO.C : C which is known to be a constituent of certain orange dyestuffs (Ber. **29**, 1886; this Journal, 1896, 646; Ber. **30**, 2947), and moreover, adjacent thereto is an acid methylene group, which might alter the shade to red.

—T. A. L.

Indigo Dyestuffs, Preparation of Aromatic Aldehydes and of.

M. Konowaloff. J. russ. phys.-chem. Ges. **31**, 54—56; Chem. Centr. 1899, **1**, [19], 1074.

The author refers to his method (J. russ. phys.-chem. Ges. **30**, 960) by which he has prepared aldehydes from *m*- and *p*-xylene, from mesitylene, and from tertiary butyltoluene. The nitro-derivatives of these aldehydes when submitted to the action of acetone and alkali, are converted into the corresponding homologues of indigo: dimethylindigo, tetramethylindigo, and dimethylditertiarybutylindigo.—A. S.

α- and β-Naphthylindigo.

H. Wichelhaus. Ber. **32**, [8], 1236—1239.

The author has investigated the yield of β-naphthylindigo obtained by the method already described (this Journal, 1898, 752). The β-naphthylamido-malonic ester obtained from bromomalonic ester yields 83·5 per cent. of the theoretical amount of naphthylindoxylic ester melting at 157° C. For the conversion into indigo, the best result (54 per cent. of the theoretical amount) was obtained with a 30 per cent. lye. The product was almost entirely soluble in aniline, the residue dissolving with a brown colour in alcohol. Comparative dye tests of β-naphthylindigo and a good Bengal indigo on bleached cotton and on wool from a hydrosulphite vat, showed that the first dyeings were darker in the case of the β-naphthylindigo, but subsequent dyeings which exhausted the vat were of approximately the same strength. The shades on cotton are as fast to acid, chlorine, and washing as an ordinary vat blue, and on wool the same holds true with regard to milling and acid. Further dyeing experiments show that naphthylindigo will give a series of shades hitherto unattainable directly. They are, however, somewhat dull, and will generally require toning with a red dyestuff. Under the action of concentrated sulphuric acid at the ordinary temperature, α-naphthylindigo forms a disulphonic acid. On the other hand, β-naphthylindigo gives, with concentrated sulphuric acid, a monosulphonic acid, whilst with fuming sulphuric acid (25 per cent. SO_3) a trisulphonic acid is obtained, and with fuming acid of 40 per cent. anhydride or with chlorosulphonic acid, a tetrasulphonic acid is formed. With regard to the dyeing properties of the sulphonic acids, silk exhausts an acid bath, whilst wool is dyed from a bath acid with sulphuric acid and containing sodium sulphate. The shades given by the different sulphonic acids on wool are similar and bluish-green. They give brighter shades than those obtained from an indigo vat, but do not dye so evenly as indigo carmine, although they are much faster to light than the latter, and are perfectly fast to milling.—T. A. L.

Azo-Colouring Matters prepared with the Halogen and Nitro Derivatives of the Phenetidines; Relations between the Colour and Constitution of Certain.

F. Reverdin and F. Düring. Rev. Gen. des Matières Colorantes, 1899, **3**, 170—171.

The introduction of a nitro group into a diazotisable amine changes the shade of the azo-colouring matter derived from it, and the nature and extent of the change varies according to the relative position of the nitro and the amido or azo groups, *e.g.*, diazotised *m*-nitraniline coupled with salicylic acid gives a yellower colouring matter than diazotised *p*-nitraniline. The authors have observed that the introduction of chlorine or bromine has a similar effect to that of the nitro group, and have investigated the effect of the introduction of Cl, Br and NO_2 in the molecule of amidophenetol (phenetidine) with regard to the shade of the colour produced on a fabric prepared with β-naphthol and developed with the diazotised amine.

The chlorine compounds yield shades which are faster to light than the bromine derivatives. Comparing the chlorine derivatives which differ in the relative position of OC_2H_5, NH_2, and Cl, the one which gives the most violet shade of red is $C_6H_3(OC_2H_5)(NH_2)Cl = 1:2:4$. Rather less blue is the red from $C_6H_3(OC_2H_5)(Cl)NH_2 = 1:2:4$, while those from *m*-amidophenetol, *viz.*, $C_6H_3(OC_2H_5)(Cl)NH_2 = 1:2:5$, or $1:4:5$ give the most orange shades, especially the $1:4:5$ derivative. The same relation of colour to composition is true for the bromine derivatives which yield colours slightly more violet than the corresponding chlorine compounds.

It thus appears that the derivative which yields the most orange shade is that in which the atom of chlorine is nearest to the amido group; and since *o*-amidophenetol itself gives a more violet shade than that of the chlorine derivative in which Cl is in para position to OC_2H_5, it is evident that the modifying influence of the chlorine atom on the colour increases in intensity as the chlorine approaches more nearly the amido group.

Nitro Derivatives.—The compound—

$$C_6H_3(OC_2H_5)(NO_2)NH_2 = 1:3:4,$$

yields the bluest shade. A little less violet is the colour from $C_6H_3(OC_2H_5)(NO_2)NH_2 = 1:2:5$, while—

$$C_6H_3(OC_2H_5)(NO_2)NH_2 = 1:2:4, \text{ and}$$

$C_6H_3(OC_2H_5)(NH_2)NO_2 = 1:2:4$ give reddish orange shades. The conclusions with respect to chlorine and bromine thus do not hold good for the nitro group. It can only be said that $C_6H_3(OC_2H_5)(NH_2)NO_2$ yields a colour much more orange in tone than those derived from the corresponding halogen substitution products.—R. B. B.

Colouring Matter of Cotton Flowers.

A. G. Perkin. Proc. Chem. Soc. **15**, [212], 161—162.

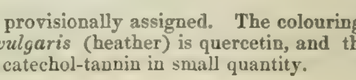
The flowers of the cotton plant *Gossypium herbaceum*, are employed as a dyestuff in the Manipur district of India. They contain as glucoside a new colouring matter, *gossypetin*, $C_{16}H_{12}O_8$, soluble in alkalis with an orange red colour, becoming green on oxidation. The *hexacetyl* compound, $C_{16}H_6O_8Ac_6$, colourless needles, m. p. 212°—216°; the *sulphate*, $C_{16}H_{12}O_8,H_2SO_4$, the *hydriodide*, $C_{16}H_{12}O_8,HI$, orange red needles, and the *monopotassium* salt, $C_{16}H_{11}O_8K$, a crystalline powder, have been prepared. Gossypetin contains no methoxyl groups, and on fusion with alkali yields phloroglucinol and protocatechuic acid. It is probably a member of the flavone group of colouring matters. Gossypetin is similar to, but not identical with, thujetin, which is present in *Thuja occidentalis* (Kawalier, Jahresbericht, 1858, 512).

Note on Rottlerine.—The decomposition products of rottlerine, $C_{33}H_{30}O_9$, a colouring matter of kamala, *Mallotus Phillipinensis*, previously described (Trans. 1893, **65**, 981; 1895, **67**, 230), are with fused alkali, acetic and benzoic acids, and with nitric acid, *o*- and *p*-nitrocinnamic acids. It has now been found that fused alkali at 220°—240° yields also phloroglucinol.

Colouring Matters of Dyer's Broom and Heather.

A. G. Perkin and F. G. Newbury. Proc. Chem. Soc. **15**, [212], 179.

The *Genista tinctoria* (dyer's broom), a yellow dyestuff formerly of some importance, contains two colouring matters, the first identical with the luteolin of weld (*Reseda luteola*), and the second, a new colouring matter, *genisteïn*. The latter has a composition corresponding to the formula $C_{14}H_{10}O_5$, colourless needles, and yields an acetyl derivative, $C_{14}H_7O_5(C_2H_3O)_3$, m. p. 197°—201°, and a tetra-bromo-compound, $C_{14}H_6Br._4O_5$, colourless needles melting above 290°. On decomposition with alkali, it gives phloroglucinol and an acid of the formula $C_8H_8O_3$ m. p. 147°—149°; this, with fused alkali, forms parahydroxybenzoic acid, and appears to be *parahydroxyphenylacetic acid*. *Genesteïn dimethylether*, colourless leaflets, m. p. 137°—139°, is insoluble in alkaline solutions, but forms a *monacetyl derivative* of the formula $C_{14}H_7O_3(OCH_3)_2.Ac$, fine needles, m. p. 202°—204°. A second product of the methylation, formed in minute quantity, melts at 187°—189°, and appears to be isomeric with the above ether. In dyeing property, genisteïn closely resembles apigenin and vitexin, and to it the constitution of a *trihydroxyphenylketocumaran*,—



$$(OH)_2.C_6H_2 \left\langle \begin{matrix} O \\ CO \end{matrix} \right\rangle CH.C_6H_4(OH)$$

has been provisionally assigned. The colouring matter of *Calluna vulgaris* (heather) is quercetin, and there is also present a catechol-tannin in small quantity.

Indigo, The Valuation of. W. Holtschmidt. Zeits für angew. Chem. 1899, 451—475.

See under XXIII., *page* 712.

PATENTS.

Secondary Disazo-dyes from Nitro-amidophenol-sulpho-acids, The Manufacture and Production of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 14,251, June 28, 1898.

The nitro-amidophenol sulphonic acids employed in this invention may be obtained by nitrating amidophenolsulphonic acids, by sulphonating nitro-amidophenols or by the partial reduction of dinitrophenolsulphonic acids. The acids so obtained after diazotisation are combined with α-naphthylamine or with one of Cleve's sulphonic acids or with any amido compound which after combination is capable of further diazotisation and combination with ordinary dyestuff components. The following examples are typical of the methods employed. About 10 kilos. of phenol are warmed with about 13 kilos. of concentrated sulphuric acid, the melt is poured into 100 litres of water mixed with 40 kilos. of nitric acid (62 per cent. HNO_3), and heated to boiling until a sample on cooling deposits crystals of dinitrophenol. The whole melt is then cooled, filtered from dinitrophenol and the filtrate treated with 10 kilos. of potassium carbonate to precipitate the potassium salt. In order to reduce the product, about 30 kilos. of it are dissolved in 300 litres of hot water and after cooling, 200 kilos. of ammonium sulphide are added. The reduction is complete in about 2—3 hours when the nitro-amidophenol sulphonic acid is precipitated by adding hydrochloric acid. The potassium salt is only slightly soluble in cold water. For the preparation of a dyestuff, 23·5 kilos. of nitro-amidophenol sulphonic acid are dissolved in 500 litres of water and diazotised with 15 kilos. of hydrochloric acid (30 per cent. HCl) and 7 kilos. of sodium nitrite at the ordinary temperature. The diazo solution is then poured into 600 litres of water containing 15 kilos. of hydrochloric acid and 15 kilos. of α-naphthylamine and the whole is stirred at 35° C. until the diazo compound has been taken up. This requires about 10—24 hours when the intermediate dyestuff is filtered off and washed with cold water. The product so obtained is then dissolved in 2,500 litres of boiling water and 17 kilos. of caustic soda-lye (35 per cent. NaOH). After adding 7·5 kilos. of sodium nitrite as a concentrated solution, the whole is poured into 200 kilos. of ice, 90 litres of water and 30 kilos. of sulphuric acid (95 per cent. H_2SO_4). The precipitate which separates out and gradually becomes brown is filtered off, stirred with cold water and poured into a solution of 35 kilos. of β-naphthol disulphonic acid R made alkaline with sodium carbonate. The dyestuff is finally salted out and filter pressed and may be purified by re-dissolving and re-precipitating. "This new class of dyestuffs possesses members of various shades of colour." Those appearing to be of greatest importance are of bluish and greenish dark shades, practically black. "They are suited for dyeing woollen goods, yielding fast shades." "In most cases the dyed fabrics improve as to fastness of colour on treatment with chromates."—T. A. L.

Azo-Colouring Matters [Black] and Materials for use therefor, The Manufacture and Production of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 14,252, June 28, 1898.

The patentees in the present specification confine themselves to the employment of a particular nitro-amidophenol sulphonic acid having the constitution—

$$1.2.4.6.C_6H_2.OH.NH_2.SO_3H.NO_2$$

the method by which it is obtained being that given in the preceding specification. The dyestuffs are also obtained by the method already described. These disazo dyestuffs are said to be fast to acids and light and possess high tinctorial power. If after dyeing, the goods are treated with chromates, the shades are turned more greenish and the colour is fast to fulling.—T. A. L.

Azo-Colouring Matters [Black] and Materials for Use therefor, The Manufacture and Production of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 14,253, June 28, 1898.

This specification also refers to the production of dyestuffs from a new nitro-amidophenol sulphonic acid having the constitution $1.2.4.6.C_6H_2.OH.NO_2.NH_2.SO_3H$. This acid is obtained by nitrating *p*-amidophenol-*o*-sulphonic acid, and can be employed for the manufacture of secondary black disazo-dyestuffs which possess the valuable properties already alluded to in the preceding specification. The formation of the dyestuff has also been described, and, with regard to the preparation of the nitro-amidophenol sulphonic acid, the following quantities are employed:—About 756 kilos. of *p*-amidophenol-*o*-sulphonic acid are gradually added to 3,200 kilos. of concentrated sulphuric acid (95 per cent. H_2SO_4) at the ordinary temperature. The mixture is then cooled to −5° C. and treated with 400 kilos. of nitric acid (62 per cent. HNO_3) and 400 kilos. of sulphuric acid (100 per cent.) at a temperature below 0° C. The melt is then poured on to ice, and the nitro acid is well washed with cold water, filter-pressed, and dried. The acid is nearly insoluble in alcohol and in cold water, and forms a mono- and a disodium salt, the former giving a reddish-yellow and the latter a deep red solution in water. The diazo compound is readily soluble.—T. A. L.

Colouring Matter [Naphthazarin], The Manufacture and Production of a New Product suitable for Use as a. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 15,708, July 18, 1898.

In the manufacture of Naphthazarin in a sulphuric acid melt an intermediate product is obtained which readily dissolves in water to a blue solution. The patentees find that on reduction this product is converted into a leuco compound which can be used directly for dyeing on chrome mordants or else in the form of its bisulphite compound. The shades obtained are greener than those given by Naphthazarin, and are very fast to light. Five hundred kilos. of a Naphthazarin melt (corresponding to 15 kilos. of Naphthazarin) are poured into 2,500 litres of water, giving a blue solution. After filtering, a solution of 40 kilos. of stannous chloride in 230 litres of hydrochloric acid (32 per cent. HCl) are added. The deep blue solution changes first to red and then becomes colourless, and the new product separates in colourless needles, which are filter-pressed, washed, and dried, or kept as paste. The new product forms bluish crystals when dry, and dissolves in sodium carbonate to a reddish-violet solution, whilst caustic soda-lye forms a red solution which turns bluish-violet on exposure to the air and deposits a precipitate having a metallic lustre. The solution in concentrated sulphuric acid is red, turning brown on heating.—T. A. L.

Colouring Matter [Naphthazarin], The Manufacture and Production of New. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 15,709, July 18, 1898.

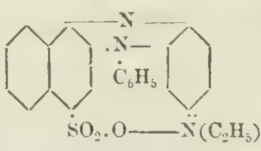
If instead of reducing the intermediate product alluded to in the preceding specification, it be treated with an oxidising agent, a dyestuff is produced which gives greener shades on chrome mordants than Naphthazarin. The blue solution obtained, as in the preceding specification, has added to it 200 kilos. of a sodium hypochlorite solution (6° B.). A green precipitate separates out which may be used for dyeing directly or in the form of its bisulphite compound. The solution in sodium carbonate is bluish-violet and blue in caustic soda-lye, whilst the compound dissolves with a brown colour in concentrated sulphuric acid.—T. A. L.

Azo-Colouring Matters [Black] and Materials therefor, The Manufacture and Production of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 16,650, July 30, 1898.

This is an application of the method already described in Eng Pats. 14,251, 14,252 and 14,253 of 1898 (see above) to a nitro-amidophenol sulphonic acid in which the nitro group is para to the hydroxyl, the substance having the constitution 1.2.4.6 $C_6H_2.OH.NH_2.NO_2.SO_3H$. It can be obtained by partial reduction of the dinitrophenol sulphonic acid described by Post (Ber. **7**, 1323), and crystallises from hot water in colourless crystals containing one molecular proportion of water. About 600 kilos. of *o*-*p*-dinitrophenol-*o*-sulphonic acid potassium salt in 400 litres of water are mixed with a concentrated solution of 112 kilos. of potassium hydrate. To this is then added with constant agitation a solution of 1,350 kilos. of crystallised sodium sulphide in the same quantity of water, care being taken that the temperature does not rise above 20° C. The potassium salt of the dinitro acid gradually dissolves, and the potassium salt of the nitro-amidophenol sulphonic acid separates in reddish crystals. The free acid precipitated by a mineral acid generally forms pale greyish-brown flakes. The diazo compound forms a greenish-yellow solution, and readily combines with α-naphthylamine or with α-naphthylamine 2′- or 3′-sulphonic acid. The intermediate compound so obtained after diazotisation is combined with a dyestuff component, preferably a naphthol or amidonaphthol sulphonic acid, giving violet-black to blue-black dyestuffs for wool.—T. A. L.

Colouring Matters [Blue-Violet] of the Safranine Series, Impts. in the Manufacture of. J. Imray, London. From The Actien-Gesellschaft für Anilin-Fabrikation, Berlin. Eng. Pat. 14,961, July 7, 1898.

The process consists in heating the aposafranine sulphonic acids (obtained by treating the aposafranines with sulphites or bisulphites) with ammonia or primary amines, whereby the sulphonic group is substituted by the imido group or its substitution product. For example, 9 kilos. of the isorosinduline sulphonic acid having the constitution—



(obtained by the action of a sulphite on the aposafranine prepared from nitrosodiethylaniline and phenyl-β-naphthylamine), 90 kilos. of alcohol and 3 kilos. of *p*-phenylene diamine are cohobated until the isorosinduline sulphonic acid has disappeared. The alcohol is then distilled off, the dyestuff is dissolved in dilute hydrochloric acid, and salted out. It gives greenish-blue shades on tannin-mordanted cotton. (See also Eng. Pat. 24,410 of 1897; this Journal, 1898, 1039.)—T. A. L.

Writing Ink, Improved. S. and A. Lichtentag, New Orleans, U.S.A. Eng. Pat. 24,644, Nov. 22, 1898.

Finely divided carbon (lampblack) (2 oz.) is mixed with 2 oz. of soap and the mixture is made up with water to 1 gall.—S. K.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Cotton Fabrics, A Process for Increasing the Lustre of. G. Knoop. Rev. Gen. des Matières Colorantes, 1899, **3**, 174—175.

The process of Thomas and Prévost which is now so widely employed for lustreing cotton yarn, has not proved equally successful in the case of piece goods, and no perfectly satisfactory method has been devised for imparting a silky lustre to cotton fabrics. The following process is suggested as being easily and cheaply carried out; without imparting the full lustre of silk it very materially increases the gloss of the fabric.

The material is padded in caustic soda at 20° B., with or without the addition of glycerin or Turkey-red oil, at a temperature of 40°—50° C. After padding, the fabric must pass *immediately* to the drying cylinder, on coming from which it is hard and brittle, and requires careful handling. It is passed through sulphuric acid at 4°—5° B., washed thoroughly, and again dried, it may then be bleached, if desired, in a weak chlorine bath.

A fabric thus treated has undergone very little contraction and has acquired increased flexibility and thickness, no mercerising action has taken place, in fact the attraction for colouring matters is diminished. When viewed at a distance and in large folds, the material shows a beautiful silky reflection. Much depends on the quality of the fabric treated; a good quality of satinette gives an excellent result.—R. B. B.

Oxycelluloses, Some Colour Reactions of. E. Jandrier. Comptes Rend. **128**, [23], 1407.

See under XXIII., *page* 711.

PATENTS.

Fibres, Yarns, and Fabrics to Imitate Silk, Impts. relating to the Treatment of. E. Ungnad, Berlin. Eng. Pat. 11,419, May 19, 1898.

Silk is dissolved, to a convenient concentration in caustic soda-lye of 35°—40° B., under heat.

The fabrics are soaked in this solution and freed from excess by centrifugators or rollers. They are then digested for ¼ to ½ hour in a bath containing bicarbonate of soda of 10° B., or they may be hung in a chamber and washed, gaseous combustion products, containing carbonic acid, passed through.

By this means the silk is deposited on the fabric. The latter is now lixiviated with warm water, washed well, and dried. A portion of the lixiviating mixture is treated with lime, converting it into caustic soda again. Another portion is treated with the combustion gases and thus reconverted into bicarbonate of soda.—C. M.

Apparatus for Immersing and Stretching Fibres, especially applicable for Mercerising Vegetable Fibres in the form of Hanks, Impts. in or connected with. P. S. Marshall, Huddersfield. Eng. Pat. 13,953, June 23, 1898.

Hanks of yarn are fitted over wooden rods, which are coupled together by other rods, so as to form a chain. The chain is passed over pairs of discs, which have extensible radii, so as to give a stretch to the yarn. The discs are situated in the mercerising and washing tanks. The rods in the hank chain have star wheels fitted at the sides which gear into segmental racks placed in the tanks, thus giving a turn to the hanks as they pass through the liquid.

After leaving the mercerising tank, the yarn passes through squeeze rollers into a similarly fitted washing tank. Any number of tanks may be used, either for mercerising or washing. (See also this Journal, 1898, 149, 240, 345, 452, 573, 756, 840, and 1141; 1899, 36, 136, 267, and 490.)—C. M.

Machinery or Apparatus for Dyeing, Bleaching, and Mercerising Cloth, Impts. in. J. Nelson, Blackpool. Eng. Pat. 14,917, July 7, 1898.

A process by which all the operations of boiling, bleaching, mercerising, &c., may be performed in the continuous passage of the cloth through several vats, by means of suitably arranged rollers.

The rollers, to prevent uneven shrinking, may be covered with perforated metal.

The dye solution may, if desired, be applied to the cloth before its passage through the dye vat in the form of a spray.—C. M.

Ramie or other Textile Plants, Improved Apparatus and Process for the Treatment of. C. L. Bachelerie, Paris. Eng. Pat. 26,377, Dec. 13, 1898.

Ramie stalks, or other textile plants are placed loosely in a large cylinder, capable of withstanding two atmospheres pressure, and the door bolted on.

This cylinder is connected by a valve with a small generator which produces carbonic acid gas. The floor of the generator is covered with pulverised bicarbonate of soda, and the hydrochloric acid is contained in a pan which can be tilted by suitable device.

The stalks are treated for from 8 to 10 minutes and, in this way it is claimed that the fibres do not need to be degummed and decorticated, but separate easily in subsequent operations.—C. M.

Drying and Carbonising Vegetable Matter from Animal Fibre, such as Cotton from Wool; Impts. in Apparatus for. T. Lee, Philadelphia. Eng. Pat. 2620, Feb. 6, 1899.

A process, in which, by means of elaborate machinery described in the patent, vegetable matter, containing wool is thoroughly dried and treated with acid gas. The wool is thereby carbonised and falls as dust, and arrangements are described whereby this dust is separated from the cotton. —C. M.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Hat Dyeing, Black. Oesterr. Ungar. Hutmacher-Zeit. **16**, [2], 3.

A good black dye, specially adapted for dull-finished hats, by reason of its penetrating power and uniformity, can be prepared from Naphthylamine Black 4 B, and Naphthol Blue-black combination (Cassella) in the following proportions:—

(1.) Naphthylamine Black 4 B, 14 per cent.; Tropæolin OO, 2 per cent. (2.) Naphthylamine Black 4 B, 10 per cent.; Naphthol Blue-black, 4 per cent.; Tropæolin, 2 per cent. (3.) Naphthylamine Black 4 B, 12 per cent.; Naphthol Blue-black, 4 per cent.; Indian Yellow No. 9, 2 per cent.

The hat bodies are damped with boiling water and entered in the bath which, in addition to the dyestuffs, contains 5 per cent. of acetic acid and 10 per cent. of sodium sulphate. The temperature being raised from about 100° F. to boiling heat, in half-an-hour, is maintained thereat for $\frac{3}{4}$—1 hour, from 5 to 6 per cent. of sulphuric acid being added in a diluted state, by degrees, to ensure exhaustion of the bath.

If properly dyed, these blacks will not run, and the colour is very fast both to water and air; any running when the dyed bodies are exposed to boiling water, is due to an insufficiency of acid. There being no preliminary mordanting to attack the fibres of the felt, the softness of texture of the material is preserved.—C. S.

Printing Black on β-Naphthol Ground [Developed Azo Colours]. L. Caberti. Färber Zeit. 1899, **10**, [8], 120—122.

No perfectly satisfactory product has yet been discovered which gives on a ground of β-naphthol a black colour analogous to Paranitraniline Red, &c. It has been attempted to obtain a black of this kind by printing a mixture of paranitraniline or benzidine with dianisidine but without useful result. The author has experimented with the four compounds intended for this purpose now on the market, *viz.*:—Azotol and amidonaphthol (Cassella), Azophor Black (M. L. and B.), and Ice Black (Kinzlberger).

Amidonaphthol.—The fabric printed with this compound must be passed through diazotised paranitraniline in order to develop the colour and the product can therefore be used only for a black on a plain red ground, or for a black and red pattern on a white ground. In the latter case it is difficult to obtain a clear white; the best result is produced by employing animal gelatin as the thickening material. The printed amidonaphthol tends to bleed off a little in the diazo solution, and steaming does not improve its fastness. If possible the goods should not be passed through the solution, but between a pair of squeezing rollers, one of which is thickly wrapped with linen saturated with the solution; the pressure must be very strong and the printed side turned away from the wrapped roller. The black is full and very fast, and is well suited for red and black patterns on flannels, moleskins, &c.

Ice Black B.O.—This product gives a very brownish-black which on soaping changes to a violet-blue. The author does not consider it a useful colour on account of the tone of the black and the unstable nature of the printing colour.

Azophor Black.—This possesses the great advantage that it does not require to be diazotised. Unfortunately the shade is a deep maroon rather than a black, especially when the printing colour is not freshly prepared.

Azotol C. requires to be diazotised, but this operation is easily carried out, and the colour prints very evenly. The tone of black is fairly good, but not perfect, it is similar to a good logwood black but with a certain brownish reflection which is especially noticeable in figures of medium or large size. Azotol is very suitable (and the same remark applies to the other products described) for printing small objects such as dots, stripes, or flowers.—R. B. B.

PATENTS.

Waterproof Fabrics, Impts. in Means for Printing. H. Gotliffe, Manchester. Eng. Pat. 11,951, May 26, 1898.

To produce lustrous or silk-like effects, the fabric is first proofed with rubber in the ordinary way. Then finely-ground dry egg albumin, or resin, is dusted on and the surface thus prepared, is printed with a solution of thickening containing nickel dust and resin; 6 parts of nickel, 16 parts of resin, and 1 part of naphtha are said to give good results.—S. K.

Mixed or Multicoloured Yarns and Fabrics, Impts. in the Manufacture of. F. Meyer, Aix-la-Chapelle. Eng. Pat. 15,386, July 13, 1898.

Woollen fibre, consisting of wool or "tops" or "noils" or any other kind of woollen material is mordanted in any suitable way, say, with chromic acid.

It is then mixed well with unprepared woollen fibre, or with fibre mordanted in a different way.

These are then spun together and made into hanks, or they may be woven. The fabric, whether in hanks or in the piece, is then dyed with suitable dyestuffs, and an effect of two or more shades, according to the different kinds of mixture is produced.—C. M.

Electric Dyeing, Impts. in the Art of, and in Apparatus therefor. G. D. Burton, Boston, U.S.A. Eng. Pat. 23,827, Nov. 12, 1898.

The apparatus is illustrated by six figures. 1. "In a dyeing apparatus, the combination of a dye-vat, a dye-liquor therein, two electrodes disposed in contact with said liquor, and connected with opposite electric poles, the positive electrode being composed of carbon and the negative of lead. 2. . . . . . and a non-conducting roll disposed in said dye liquor, and adapted to serve as a guide for the fabric being dyed. . . 3. . . . . the roll composed of porcelain. 4. . . the combination of a dye-vat composed of non-absorbing non-conductive material, a dye liquor therein, and two electrodes disposed in contact with said liquor. . . 5. . . two electrodes composed of copper. . . 6. . . an electric current of 40 or more volts passed through said liquor . . . . liquor being free from dissolving metal during the dyeing operation. . . . 7. . . intermingling a dyeable fibrous substance with a dye liquor, and passing an electric current of 40 or more volts through that part of the dye liquor with which said fibrous substance is intermingled, whereby the fibres thereof are forced apart and thoroughly exposed to the action of the dye liquor. . . . 8. . . . passing an electric current of 40 or more volts, and of sufficient volume to maintain the liquor considerably above the normal temperature, through that part of the dye liquor with which said fibrous substance is intermingled."—J. C. R.

VII.—ACIDS, ALKALIS, AND SALTS.

Thirty-fifth Annual Report on Alkali, &c. Works, by the Chief Inspector. Feb. 8, 1899.

This report shows a continued diminution in the number of works registered under the Acts in England, Ireland, and Wales, the figures being for 1896-7-8, 1074, 1,058, and 1,052 respectively. Among these, the "Alkali Works," taken in the same order, are 98, 87, and 86. Only slight variations are shown in the number of "separate scheduled processes of manufacture," the principal changes being, as compared with the preceding year, an increase of 11 under "sulphate and muriate of ammonia;" a decrease of four under "salt," and an increase of four under "cement." In Scotland the number of alkali works registered was the same as in 1897; and the total "processes under inspection" were, for 1897, 204; and for 1898, 206. There has been no material change, as compared with the preceding year, in the amount of the escape of acid gases, except in the case of manure works, in which the escape averaged for 1897, 0·297 grains of SO_3 per cubic foot, and in 1898, 0·364 grains. The escape of HCl in chimney gases in alkali works shows a very slight increase, but calculated as percentage on the acid produced, has diminished from the average of the preceding year. In the Chance-Claus process of treatment of alkali waste, in which from 10 to 15 per cent. escapes in gaseous form, and as finely-divided sulphur, not much progress has been made, although the sub-inspectors report that little or no unburnt H_2S is found in the chimney gases. The general reaction in this process is stated to be—

$$(1.)\ H_2S + O - H_2O + S,$$

but this reaction is accompanied by development of heat, and if this heat increases to a certain extent, a counter reaction commences, namely—

$$(2.)\ 3S + 2H_2O = SO_2 + 2H_2S.$$

Although this secondary reaction cannot be entirely prevented, the loss accruing may be lessened by increasing the kiln room, or, "in other words, in moderating the amount of gases per square foot of superficies in the kiln." In Scotland, the ammoniacal liquors obtained from the distillation of Scotch coals differ from those in the north and midlands of England in containing less ammonia combined with sulphur, so that the proportion of H_2S in the permanent gases is frequently below 10 per cent., and never exceeds 12·8 per cent.; but the Claus sulphur recovery process "will not work successfully unless this figure reaches 15 per cent." The treatment of the gases by hydrated ferric oxide, already in use in many works in Scotland, has presented difficulties, known also in English works, difficulties which Mr. Curphey (the district inspector) has suggested should be met by the use of solution of a ferric salt, so as to separate all the sulphur in the solid form.

There is no special development to record, electrolytic or otherwise, in the manufacture of chlorine, the fall in the price of bleaching powder having operated adversely to the introduction of novel processes.

An investigation has been undertaken by the chief inspector, aided by Mr. Linder, into the causes of the "black tests" and "green tests" frequently occurring in the quantitative estimation of the hydrochloric acid in chimney gases, by silver nitrate, potassium chromate being used as indicator. The occurrence of this black or green coloration of the precipitate in the end reaction renders the indicator ineffective, and proved to be due to the presence of organic matter, giving rise to some reduction to metallic silver. In some cases portions of the organic matter resist in the cold oxidation by hydrogen peroxide or by permanganate. The sometimes green appearance of the test is due "to the slaty blue of reduced silver oxide (probably a mixture of Ag_2O and Ag) seen through a layer of yellow chromate solution." When the total acidity of the gases is to be estimated as SO_3, the ordinary method of making the test is modified as follows:—"After titration with sodium bicarbonate for total acidity as SO_3, about 0·5 grm. of calcium or magnesium carbonate is added, followed by 5 to 10 drops of ferric sulphate solution (5 per cent. strength); stir for one minute, decant or filter the solution, and proceed with titration by silver nitrate as usual." In this test the precipitate of ferric carbonate carries down with it the objectionable organic matter. When it is only requisite to know the hydrochloric acid present in the gases, the practice has been to oxidise the sulphurous acid to sulphuric acid by permanganate, neutralise with sodium carbonate, and titrate with silver nitrate after filtration, using the chromate indicator: in this test the manganous sulphate formed acts as a reducing agent on silver chromate, and also some organic matter resists oxidation by the permanganate. Mr. Ballard, finding the end points uncertain, and occasional "green" tests, has improved the process by using precipitated chalk and potassium chromate ground together, after the permanganate oxidation; this ensures absolute neutrality, and overcomes the difficulty. In some works the "green test" is avoided by boiling for one or two minutes the solution that has been treated with permanganate and magnesium carbonate, with additions of permanganate until a permanent pink coloration indicates complete oxidation of organic matter; the filtered and cooled solution is then titrated. The interesting statement is made that carbon monoxide, acetylene, and coal gas, have no reducing action on silver chromate. "Organic matter obtained in solution by distillation of coal, or by acidifying gas liquor, gave a somewhat brown end point, the colour deepening on standing, but nothing resembling a green test."

In the report for the preceding year, an account was given (this Journal, 1898, 665) of experiments made as to the causes of certain anomalies that arose in conducting the tests on the escapes of acid gases from various sulphuric acid exits. The results then obtained have been confirmed, and the conclusion is arrived at "that a sampling tube placed at right angles to the flow of gas in such flues exerts a selective action, the larger liquid particles being less readily diverted to the aspirator or absorbing vessel in virtue of their superior mass, and that higher results are therefore obtained with the sampling tube at right angles to the current when the rate of flow into the mouth of the sampling tube is increased, more of these heavier particles being thus diverted." When acid particles of large size are present, slow or quick aspiration leads to great divergence of results. Tabular statements are made of several experiments, and the subject is still being further investigated.

The production of sulphuric acid in the United Kingdom is shown by statistics to approach, if it does not exceed, 1,000,000 tons annually, and the consumption of pyrites exceeds 600,000 tons. It is from pyrites kilns chiefly, that objectionable escapes of acid fumes take place, especially when the doors of the kilns are opened for pokering or charging. The inspector states that plant can now be designed and worked without any escape coming from this source. It is important that the base of the Glover tower should be raised far enough above the top of the pyrites kiln to give an upward movement to the entering gases; also that the bricks should be wider apart than has been usual. In Scotland, where, in the leading vitriol works, the bases of the towers have been raised one by one, the result has been to completely remove the low-level escapes. Messrs. Doulton have devised a new packing for Glover towers, consisting of acid-resisting tiles 9 ins. by 9 ins. by 3 ins., with four 3-in. square holes in each tile, which are laid in cross layers above the arch. The use of these in the towers has been found to entirely remove back pressure in the kilns; to afford easy concentration of chamber acid on a reduced temperature in the tower; and to give "almost perfect denitration of the Gay-Lussac tower acid," besides many concomitant advantages. The use of automatic dampers for controlling the variations in draught during stormy weather, recommended in the inspector's previous report, has been extended with excellent results. A simple and effective form of the damper is described on page 74. The Lunge-Rohrmann tower has, according to a letter from Prof. Lunge to the chief inspector, been very extensively used abroad, and in England, at the Briton Ferry Chemical Company's Works, near Swansea (not under inspection), and in two English vitriol works besides. The inspector has seen the towers in operation at Pontardawe, and expresses a favourable opinion of them.

In sulphuric acid concentration plant, experience has not proved favourable to the "stepped beaker" system, which has given much trouble through breakage of vessels, and escape of acid into the brickwork; the economy in fuel of the process is considerable, but this has not been found to compensate for disadvantages in other respects. In Scotland, the Kessler concentrating apparatus has been worked very successfully, though with some modifications on the original plant; the bye-pass from the furnace to the chimney has been dispensed with; and the direction of the gases through the final scrubber is reversed, being *downwards*, not upwards. The results obtained have been carefully observed, discussed, and tabulated. The process, at the date of the issue of this report, had not been installed in England, but was to be so in the current year at the Government works at Waltham Abbey, which are not subject to inspection. In the over-heat concentrating pans largely in use, the rate of working is apt to be too high, leading to objectionable escape of acid vapours, against which the inspector warns the manufacturers. The conditions under which the system may be worked without offence have been investigated, and are given partly in tabular form.

The following table shows the—

Amount of Sulphate of Ammonia produced in the United Kingdom.

——	1898.	1897.	1896.
	Tons.	Tons.	Tons.
Gas works	129,590	132,724	127,498
Iron works	17,935	17,779	16,511
Shale works	37,264	37,153	37,822
Producer, gas, coke, and carbonising works.	11,568	10,624	9,078
Total	196,357	198,280	190,909

The entire produce from the "shale works," and the greater part of that from the "iron works," is due to Scotland. The increasing proportion of water-gas made in gas works from coke and steam, referred to in the preceding report as a cause of reduction in the output of ammoniacal salts, continues in operation, even to the extent of converting the normal annual increase into a decrease. Much vigilance is needed to restrict the nuisances liable to occur in the distillation of ammoniacal liquors, and the chief inspector especially warns manufacturers against the practice of cooling the gases from the sulphate of ammonia saturator by an internal spray of water, whereby much hydrogen sulphide is liable to be carried away in solution, and, if it flows into a town sewer, grave danger may ensue to the men whose business it is to keep the sewers clear. "The water condensed should be taken off at the *hottest possible point*, and so be associated with the minimum of sulphuretted hydrogen and of pyridine." The series of examinations into the constitution of ammoniacal liquors recorded in the last two annual reports, is continued, with special attention to marked differences between liquors from English and Scotch sources. In the course of these investigations, a method was experimented on for eliminating the effect of the presence of organic matter on the iodine determination. To this end, two solvents were tried, ether and carbon bisulphide, of which the latter proved to be superior. Details are given of the manner of carrying out the test, so as to avoid the source of error, and a table is given showing the comparative results of the different methods.

The Portland cement industry has shown renewed activity within the last two or three years, and lately many new kilns have been erected. Chamber kilns are now chiefly used, but many of the objectionable open-topped form still exist. The fume from these may be seen rolling along the ground, and on the water, in some reaches of the Thames, such clouds constitute a danger to navigation, and steamers have been heard to blow their fog horns on passing the cement works. It appears that a part at least of this fume is due to the presence of finely-divided solid matter, such as chlorides; and if, in making the slurry, fresh water is used instead of brackish water, the nuisance is greatly lessened.

Attention is directed to section 25 of the Alkali Works Act of 1881, which renders workmen directly responsible for the consequences of carelessness, disobedience, or wilful neglect, in such manner that a workman may be prosecuted under the Act instead of his employer, in case the latter has done his best to carry out the obligations imposed. In one instance proceedings were instituted under a clause in this section, although they were subsequently withdrawn, on dismissal of the offending workman by his employer.

This report, the fourth furnished by Mr. R. Forbes Carpenter, contains 143 pages, of which 17 are devoted to Scotland.—E. S.

Nitric Acid, so-called "Chemically Pure"; Occurrence of Iodic Acid in. A. Whitby. J. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 53—54.

Having detected iodic acid in nitric acid, probably prepared from Chili saltpetre, by the peculiar pink colour which develops in the dilute acid, and by a distinct halogen precipitate in the parting flask (gold and silver), although none with the freshly mixed acid, the author has devised the following test:—50 c.c. of the acid are evaporated to dryness, the final temperature to be kept below 200° C., and the residue is dissolved in water acidulated with HCl, and a few drops of starch added. Sulphurous acid or sodium sulphite solution is gradually dropped in, by which the following two consecutive reactions take place, the disappearance of the blue coloration indicating the end:—

$$2HIO_3 + 5H_2SO_3 = I_2 + 5H_2SO_4 + H_2O.$$
$$I_2 + H_2SO_3 + H_2O = 2HI + H_2SO_4.$$

Two equivalents of iodine as iodic acid require six equivalents of sulphurous acid, or 1 c.c. of $\frac{1}{20}$ N solution of sodium sulphite = 0·002116 grm. of iodine as iodic acid. As much as 0·031 to 0·086 per cent. of iodic acid has been found, and the author has noticed the evolution of iodine vapours during the annealing of cornets.

In the discussion, Dr. J. Loevy mentions the qualitative test of shaking a little chloroform with the dilute acid to dissolve out the iodine, and also adding a piece of zinc, to produce an oxide of nitrogen to release the iodine, if in combination.—A. W.

Percarbonates. S. Tanatar. Ber. 1899, **32**, [9], 1544—1546.

Constam and v. Hansen have obtained by electrolytic methods percarbonates of the composition $M_2C_2O_6$, which on heating evolve carbon dioxide and oxygen (this Journal, 1897, 537). The author has prepared percarbonates of another constitution. The sodium salt is obtained by dissolving 7·5 grms. of sodium carbonate in 100 grms. of 3 per cent. hydrogen peroxide and adding 3 vols. of alcohol after 5—10 minutes. After washing with alcohol and ether and drying over sulphuric acid, the salt has the composition $Na_2CO_4 + 1{\cdot}5H_2O$. It contains 10·77—10·90 per cent. of active oxygen, as estimated by permanganate. On heating, oxygen and water are evolved, but no carbon dioxide. In aqueous solution the percarbonate is gradually decomposed into sodium carbonate and hydrogen peroxide.

The corresponding potassium compound could not be obtained pure, a liquid salt was precipitated by alcohol, it crystallised on repeated washing with alcohol, and was probably a mixture of K_2CO_3 and $K_2CO_4 + 3H_2O$.

If in the preparation of sodium percarbonate, double the above quantity of hydrogen peroxide be employed, the salt $Na_2CO_4 + \frac{1}{2}H_2O_2 + H_2O$ is obtained, which is similar in appearance and properties to the former compound. Sodium percarbonate gives precipitates with metallic solutions, which soon decompose with evolution of oxygen, after washing and drying they contain only small quantities of substances which reduce permanganate.

The heat evolved on the decomposition of sodium percarbonate by nitric acid shows that it cannot be regarded as a double compound of hydrogen peroxide and sodium carbonate. Attempts to prepare analogous compounds with other salts containing water of crystallisation (sodium sulphate and phosphate, barium chloride, &c.) were without result.—A. C. W.

Lead Halides, The Properties of some Mixed. V. Thomas. Comptes Rend. **128**, [22], 1329.

In solutions containing lead bromide and lead iodide, or any combination of two different lead halides, an equilibrium between the quantities of bromide and bromo-iodide is established which for constant concentration depends only upon the temperature. All these mixed lead halides being, according to van't Hoff, exothermic compounds, it follows that the combining quantities of the dissolved salts increase as the temperature decreases. The double halides thus formed inter-crystallise in all proportions with the single halides contained in the solution, so that the composition of the resulting crystallisations varies within very wide limits, although lead chloride or lead bromide are not isomorphous with lead iodide.—C. O. W.

Hydrosulphides, Sulphides, and Polysulphides of Potassium, and Sodium. W. P. Bloxam. Proc. Chem. Soc. **15,** [211], 146—147.

In this paper, the author shows that there is a very important difference between treating the aqueous solution of a sulphide and one of a hydrosulphide with sulphur. When sulphur is added to aqueous solutions of potassium and sodium sulphides, some thiosulphate is always formed along with the polysulphide, whilst hydrogen sulphide is evolved. This points to the sulphide having become, in part at least, hydrolysed into hydroxide and hydrosulphide. The action of sulphur on aqueous solutions of the pure hydrosulphides gives pure polysulphides with evolution of hydrogen sulphide.

The various wet and dry methods of preparing the sulphides and polysulphides of potassium and sodium described by the many authors who have worked at this subject have been repeated by the author, who concludes that (1) none of these authors could have obtained any polysulphide pure, but only a mixture of polysulphide and thiosulphate; (2) no method exists for separating the polysulphide from the thiosulphate.

The author has succeeded in obtaining the following hydrates of potassium sulphide: $K_2S,2H_2O$; $K_2S,5H_2O$; $K_2S,12H_2O$. These salts can be dehydrated in a current of dry hydrogen, and the potassium sulphide remains stable at 560°. As $K_2S,5H_2O$ loses $5H_2O$, it is evidently not $KHS,KHO,4H_2O$. Sodium sulphide was obtained as $Na_2S,9H_2O$.

By saturation of a solution of potassium hydroxide with hydrogen sulphide, crystals of the composition $2KHS,H_2O$ were obtained, which, like the hydrates of the normal sulphide, could be dehydrated without loss of sulphur. The hydrosulphide was quite stable at 560°.

According to Sabatier, the hydrated crystals of sodium sulphide are easily converted into sodium hydrosulphide by the action of hydrogen sulphide, but the author shows that solutions of sodium sulphide will only take up sufficient hydrogen sulphide to form the hydrosulphide under certain rather restricted conditions as to concentration and temperature. Under favourable conditions, two hydrates were obtained, $NaHS,2H_2O$, $NaHS,3H_2O$, the latter being the stable form.

To prepare the polysulphides, sulphur was dissolved in gently heated solutions of the hydrosulphides, when the following potassium compounds were obtained: $K_4S_5,10H_2O$, $K_4S_8,6H_2O$, $K_4S_8,19H_2O$, K_4S_9,xH_2O, K_4S_{10},xH_2O, as well as substances approximating in composition to K_4S_6 and K_4S_7.

The only sodium compound obtained in this way was $Na_4S_9,14H_2O$.

Chlorates, The Decomposition of with Special Reference to the Evolution of Chlorine and Oxygen. W. H. Sodeau. Proc. Chem. Soc. **15,** [212], 157—158.

Some chlorates, on being heated, give off almost all their chlorine as such, whilst other chlorates give none. According to Schulze, the chlorate breaks up into chloride and oxygen, the chlorine evolved being due to the nascent oxygen attacking the chloride, whilst Spring and Prost regard the chlorate as decomposing into oxide, chlorine, and oxygen, the chlorine being more or less reabsorbed. The author points out that in addition to these two theories, two others are possible, (1) that chlorates may break up in both of these ways simultaneously, and (2) that chloride and oxide may represent the balanced action of chlorine and oxygen.

His experiments have been made chiefly with potassium and barium chlorates. The former gives no chlorine, whether the pressure of the evolved gas be kept at 1 m.m. or at one atmosphere. With barium chlorate, however, 0·066 per cent. of the total chlorine was evolved when the pressure was kept at 1 to 2 m.m. and the duration of the experiment 233 minutes, whilst at atmospheric pressure, 0·093 was obtained when the duration was 165 minutes, but when very rapidly decomposed (half a minute), the percentage of chlorine evolved rose to 0·705. These are the averages of several experiments.

From the results of his experiments, the author concluded that when barium chlorate is heated, it undergoes two decompositions at the same time: (*a*) an exothermic decomposition into chloride and oxygen, (*b*) an endothermic decomposition into oxide, chlorine, and oxygen, and that no appreciable reaction takes place between the chloride and oxygen (or chlorate), or between the oxide and chlorine, but that the increase of chlorine in a rapid decomposition may be ascribed to the great rise of temperature favouring the endothermic reaction. He believed that potassium chlorate decomposed directly into chloride and oxygen. Further experiments were being conducted on the behaviour of manganese oxides with potassium chlorate, and on the decomposition of pure lead and calcium chlorates. The experiments already performed with these chlorates appeared to confirm the author's view that these two independent reactions occurred.

Hydrochloric Acid, Electrolysis of. Haber and Grindberg. Zeits. anorg. Chem. **16,** 198; 329 and 438; through Zeits. für Electrochem. **5,** 557.

See under XI. A., *page* 690.

Acetifying Bacteria. D. P. Hoyer, Dissertation, Leiden, 1898; through Centralb. für Bakteriol. [II. Abth.] 1898, **4,** [23], 867.

See under XVII., *page* 699.

Isovaleric and Acetic Acids, Method for the Quantitative Separation of. A. C. Chapman. Analyst, 1899, **24,** [278], 114.

See under XXIII., *page* 712.

Bricks from the Waste Products of the Solvay Soda Process. Byunk. Rev. Prod. Chim. **2,** [6], 81.

See under IX., *page* 686.

PATENTS.

Caustic Alkalis, Impts. in the Purification of. G. W. Johnson, London. From Chemische Fabrik Griesheim, Frankfort-on-Main, Germany. Eng. Pat. 11,650, May 23, 1898.

The process of purification employed is that of dialysis, and the main feature of the invention consists in the use of highly concentrated lyes, diffused into water with or without the use of a "membrane of organic or inorganic material." In one of the examples given, a potash lye of a sp. gr. of 50° B., and containing potash and potassium chloride in the proportion of 100 : 1·47, gave a diffusate of 7° B., in which the corresponding proportion was 100 : 0·025. In another experiment, in which lye of the same strength was used, and kept, by additions of strong lye during diffusion, at or above 45° B. density, the diffusate had a density of 30·5° B., and the proportion of potash to chloride in it was 100 : 0·044. A crude caustic soda-lye, containing per litre, NaOH, 707 grms.; Na_2S, 5·1 grms.; NaCl, 12·2 grms.; and Na_2SO_4, 1·3 grms., and maintained during diffusion at about 47° B., gave a diffusate of 19° B., containing per litre, NaOH, 155 grms.; Na_2S, 0·016 grms.; NaCl, 0·042 grm., and traces only of Na_2SO_4. Lyes containing silicic acid, iron, alumina, and lime, are freed from these by diffusion in the manner stated. Concentration of the dialysed lyes and renewed dialysis is stated to give a product containing only "imperceptible traces" of impurities.—E. S.

Alkalis, Impts. in the Manufacture of, and in Means applicable for Use therein. J. Hargreaves, Farnworth-in-Widnes. Eng. Pat. 15,502, July 14, 1898.

The invention relates to the manufacture of alkalis from brine by electrolysis. If the brine contain a chlorate or hypochlorite, an equivalent quantity of hydrochloric acid is added. When the production of carbonic acid in the circulating electrolyte is not objectionable, sugar, sawdust, or other suitable organic matter is added to deoxidise the chlorate or hypochlorite. The carbonic acid gas which, with steam, is forced into the cathode chambers, is, when derived from coal fires, lime kilns, or the like, freed from sulphurous acid, &c. by saturating it with moisture while hot, and then cooling to condense the moisture, which latter is removed by scrubbing.

The electrolytic cell, cased with iron, has the walls of the anode compartment formed by casting Portland cement within the casing, preferably in conjunction with a filling of brick or the like, saturated with paraffin wax, pitch, or tar. A saturating vessel or compartment is provided within the cell, tubular in form, elliptical in cross section, and perforated, in which dry or new salt is placed. Or the receptacle may be formed of a series of slats to form transverse slits. Inclined metal strips, having serrated lower edges, are bedded in cement in the cathode chamber of the cell, extending from the cover-plate to the surface of the cathode, which is thus supported in close contact with the diaphragm, so that the condensed vapour is directed against the surface of the cathode, and the product is completely and expeditiously removed as it forms. The object of the serrated edges of the strips is to form openings for the free passage of the steam and gases over the surface of the cathode. The projecting parts of the wires of the woven wire cathode are flattened by rolling, in order to render contact between the cathode and the diaphragm more perfect.—E. S.

Electrolytic Cells [Alkali Salts; Mercury Cathodes]. Impts. in or connected with. G. and G. W. Bell, Liverpool. Eng. Pat. 11,570, May 23, 1898.

Apparatus for decomposing brine electrolytically with mercury cathodes, for the production of sodium hydrate and chlorine, &c.; and the improvements described relate to means "by which the mercury is readily and simply moved from the decomposing chamber to an oxidising chamber, and *vice versâ*, with an economy of mechanism or apparatus and of power." This is done by pipes and valves, the latter being shown as being actuated by electromagnetic devices.

First claim: "The herein described method of effecting the alternation of flow of mercury to and from the decomposing and oxidising chambers of an electrolytic cell, consisting in alternately raising and lowering the head of liquor on the mercury in said chambers, or one of said chambers."—J. C. R.

Alumina or Ferric Oxide, or Mixtures thereof; Impts. in Obtaining. J. T. Hewitt and F. G. Pope, London. Eng. Pat. 14,911, July 7, 1898.

Aluminium sulphate is placed in inclined, rotating tubes, heated to redness, through which steam is passed in a direction contrary to the travel of the sulphate, which may be introduced at the upper end of the tube, so as to make the process continuous. Instead of inclined and rotating tubes, fixed and horizontal, or slightly inclined tubes may be used with screw conveyors. It is preferred that the steam should be passed in such proportion as to yield an acid of from 1·5 to 1·6 density, as acid of this strength is suitable for the extraction of alumina from aluminous minerals. Ferric sulphate may be similarly treated to obtain ferric oxide and sulphuric acid.—E. S.

Chromic Acid, Production of, by Electrolytic Oxidation of Solutions of Chromium Oxide Salts. O. Imray, London. From The Farbwerke vormals Meister, Lucius, and Brüning, Hoechst a/Main, Germany. Eng. Pat. 15,724, July 18, 1898.

The claim is "for production of chromic acid by first electrolysing a solution of a chromium oxide salt in an aqueous solution of the corresponding acid, as for instance solution of chromium sulphate in aqueous sulphuric acid, then employing the mixture of chromic and other acid resulting from the electrolysis, for reactions by which it is reconverted into the solution of the oxide salt in acid, charging this at the cathode when the fluid formerly at the cathode has been transferred to the anode for formation again of chromic acid, and so on continuously." The solution of chromium sulphate to be electrolysed is made very strong, 100 grms. of Cr_2O_3 and 350 grms. of H_2SO_4 being made up with water to one litre. The cell is lined with lead, and the electrodes are of the same metal. It is stated that at a current density of more than 300 ampères per square metre, the tension amounts to hardly 3·5 volts. The process is described especially in connection with the regeneration of chromic acid from residual chromic oxide salts.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Porcelain for Low Finishing Heat. H. Stein. Sprechsaal. **32**, [6], 153—154.

To obtain a porcelain body suitable for firing at a finishing oven temperature equal to the fusing point of the No. 12—13 Seger cones, instead of the greater heat (No. 15—18 cones) required for ordinary hard porcelain, it is necessary to approximate the constitution of the body to that of Chinese and Japanese porcelain, *viz.*, an average of 30 per cent. of clay substance, 30 per cent. of felspar, and 40 per cent. of quartz. On this basis, the following mixture will produce a mass corresponding to the No. 13 cone. Zettlitz kaolin, 45 per cent.; quartz sand, 29 per cent.; Scandinavian felspar, 26 per cent. A second body, corresponding to cone No. 12, is furnished by Zettlitz kaolin, 40 per cent.; quartz sand, 35 per cent.; Scandinavian felspar, 25 per cent.

The diminished plasticity of these bodies is of little importance, as they are mostly worked up by the casting process and, besides, the plasticity may be increased by the addition of a little acid, which acts in the same manner as the acids formed during storage, by the decomposition of the organic matter in the mass.

When a lower finishing heat than cone No 12 is desired, the kaolin in the clay substance of the mass must be wholly or in part replaced by iron-free, white-burning plastic clay, such as is used in the preparation of fine white stoneware; otherwise the body will be too short in texture. Although such clays always impart a yellowish tinge to the porcelain, this is masked by the large proportion of quartz, and, if fired in a slightly reducing atmosphere, the product will be clear white. On the other hand, a highly reducing atmosphere produces a bluish tinge, and an oxidising atmosphere an ivory yellow.

The following mixture forms a body suitable for firing at a heat corresponding to Seger cone, No. 9—10; Zettlitz kaolin, 13 per cent.; brown Löthainer clay, 15 per cent.; quartz sand, 45 per cent.; Scandinavian felspar, 27 per cent.; and yields ware highly adapted for decorative purposes, though too fragile for articles of domestic use, these latter being preferably made from the two formulæ first given.
—C. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Lime, Burnt, Report of the Standardising Committee. Kossmann. Thonind. Zeit. **23**, [28], 367—370.

The points investigated by the committee were: the determination of the ratio between weight and volume of the lump lime; the method of slaking; estimation of the total yield of slaked lime, and proportion of active lime and siftings therein; physical and chemical behaviour, hydration and contraction of the product. A uniform method of slaking was pursued in the five different laboratories where the work was performed, a zinc-lined rectangular vessel of square section, 40 cm. high, and 1,000 sq. mm. floor space being used, and the lime broken into nuts of 2—3 cm. diameter. After slaking, and taking the measure and weight of the paste, the mass was washed through a sieve of 0·66 mm. mesh.

The results of the weight volume determination of the lumps varied to such a degree according to the different methods employed, that it was decided in future to estimate the weight per hectolitre from 5 kilos. of substance, in a 10 litre measure of standard dimensions.

The slaking water (13 kilos. per 5 kilos. of lime) was added in two different ways, *viz.*, in successive portions, or all at once, the initial temperature being 20°—22° C. Although the former method enables the progress of the reaction to be followed more exactly, the loss of water entailed by evaporation renders it inferior to the second plan.

The yield and density of the resulting slaked lime depending on the quantity of water absorbed, it is desirable to reduce the loss of moisture by evaporation, and this forms another argument in favour of adding the whole of the slaking water at once. According to the results so far obtained, the yield averages 24—30 cb. m. per 10,000 kilos. of lump lime, the weight of 1 cb. m. ranging between 1,150 and 1,500 kilos.

The residue left on the sieves affords an indication of the purity and burning of the lime, and consists *inter alia* of white hard granules from the silicates in the crude substance. The percentage of calcium hydroxide is estimated from 400—500 grms. of the sifted product by drying until constant.

The contraction of the slaked lime, accompanying its absorption of a larger volume of water than is theoretically necessary for the production of the monohydrate, points to the formation of polyhydrates.—C. S.

Cement under the Action of Bacteria, Decomposition of. G. Barth. Zeits. angew Chem. 1899, [21], 489.

REFERRING to the observation of Stutzer and Hartleb (this Journal, 1899, 495) the author remarks that such a destruction of the cement may occur in a relatively short time. After three years use in a waterworks reservoir, a softening and separation of the cement facing was observed. An analysis of the mud as compared with the original cement gave the following results:—

——	Muddy Separation.	Original Cement.
	Per Cent.	Per Cent.
SiO_2	33·21	20·0
Al_2O_3	21·84	7·5
Fe_2O_3	10·95	3·5
CaO	24·23	63·0
MgO	9·36	2·0

The water in the reservoir did not contain an abnormal amount of free carbonic acid, so that the crumbling of the cement seemed unaccountable. The reservoir was recemented with a cement containing a higher percentage of silica, and to all appearances this has had the desired effect.
—J. F. B.

Cement-Mortar, Determination of appropriate Mixtures. A. Unna. Thonind. Zeit. 23, [11], 107—110.

To ensure compactness in cement-mortar it is necessary that all the interstitial spaces between the particles of sand should be completely filled, and as these constitute 0·38—0·40 of the total bulk—in the case of good sand containing granules of all sizes—the author finds that mixtures of 1 vol. cement to 2—2½ vols. sand alone fulfil this requirement when very quick setting is desired. An addition of lime, though increasing the compactness of the mortar, reduces its tensile strength; but for slow setting cement mortars, trass can be advantageously added, the tensile strength continuing to increase for over a year.

For concrete, the gravel, &c. should be of assorted dimensions in order to reduce the interstitial space to a minimum—the average being 0·40 of the entire bulk—and an excess of 10 per cent. of cement-mortar should be allowed. Given sand and gravel each with 40 per cent. of interstitial space, a compact mortar can be obtained from 1 part of cement, 2½ of sand, and 6 of gravel, whilst an equally compact concrete is furnished by 1 part of cement, 1 of trass, 4 of sand, and 10 of gravel, a mixture having the same resistance to compression (145 kilos. per sq. cm. after 28 days) and 25 per cent. cheaper. On the other hand a concrete of 1 part of cement, 3 of sand, and 6½ of gravel costs more but is less compact although the internal spaces are completely filled.—C. S.

Blast Furnace Slag, Utilisation of. A. D. Elbers. Eng. and Mining J., June 3, 1899, 649.

AFTER referring to the use of blast furnace slag in the manufacture of cement (this Journal, 1897, 1016), and as an admixture to Portland cement (this Journal, 1897, 680 and 915), the author discusses the subject of the utilisation of the slag by direct conversion into building stone, &c. The efforts which have been made in this direction have not met with success up to the present, owing to defects in the products obtained, due to the presence of several per cent. of calcium sulphide in the slag. The author considers that more attention should be given to the problem of desulphurising the slag in the molten condition and states that blast-furnace slag of singulo- to sesqui-silicate constitution would—minus the sulphur—make splendid building stone for the facing of walls, capable of being tooled in the same manner as freestone, as tough as granite, more homogeneous than basalt, of more pleasing colour—from a light gray to dark brown—than the various kinds of sandstone and more resistant against atmospheric influences than the architectural limestones, including marble.—A. S.

Bricks from the Waste Products of the Solvay Soda Process. —. Byunk. Rev. Prod. Chim. 2, [6], 81—82.

THE mixture of hydrate of lime, calcium chloride, and carbonate is spread out on iron plates along with sand, and dried by heat, the evolved water vapour being drawn off by an exhaust. After causticising the dried mass by heat, it is incorporated with some hydraulic material, such as trass, pumice, sand or cement, then moistened and moulded into bricks, which are subjected to pressure and left to set hard.
—C. S.

PATENTS.

Drying Slurry, Impts. in Chambers for. G. L. Anderson, Northfleet. Eng. Pat. 14,462, June 30, 1898.

THIS is a modified Johnson kiln for drying cement slurry. The usual arch forming the roof of the kiln is shortened, so that it extends only over the front portion of the kiln, where the heat is greatest, and, in place of the removed portion, a horizontal roof of protected removable metal plates is substituted, extending from the end of the chamber, either to the portion of the arch which is left, or over this. This horizontal roof thus forms an open drying floor running the entire length of the chamber. The chamber beyond the arch is divided horizontally by a floor of removable metal plates into two compartments, one above the other, and both communicating directly with the kiln; thus, the available floor space for drying is triplicated. The connection with the chimney is by way of the lower of the two compartments. A roof is erected over the whole as a protection against rain.—H. H. B. S.

Preserving Wood, Impts. in the Process of, and Apparatus for. C. Tschurl and C. Petraschek, both of Vienna. Eng. Pat. 15,656, July 16, 1898.

THIS invention relates to a process for simultaneously drying and cooling wood before and after impregnation respectively, the heat of previously impregnated wood being utilised in drying fresh wood. The arrangement consists of two chambers communicating with each other, and connected with passages for the entry of fresh or hot air and escape of moisture-laden air, such communication and connections being controlled by valves or dampers. Each chamber is used alternately for heating and cooling.

A modification of the process is also claimed, by which the two chambers are replaced by two boilers communicating with the impregnating boiler. By this system, the preliminary heating is carried out in one boiler, the impregnation in the impregnating boiler, and the cooling in the last boiler, the working being changed each time by reversing the valves.—H. H. B. S.

Kilns for Burning Portland Cement and other Substances, Impts. in. C. Schneider, Hamburg, and V. F. L. Smidth, Copenhagen. Eng. Pat. 16,184, July 25, 1898.

A calcining chamber and a cooling chamber, both cylindrical, are arranged one above the other, the former being uppermost. The calcining chamber has a double wall enclosing an air space, communicating, at the bottom with the cooling chamber, and at the top with a flue, valves being inserted at the junction with the flue. At the bottom of the cooling chamber is a grating of loose bars. The cement material and the fuel are introduced through doors at the top of the calcining chamber, and as the burnt materials gravitate to the bottom of the cooling chamber, they are withdrawn through the grating.—H. H. B. S.

Fireproof Substance and Composition (Non-conducting), especially Applicable for Use in the Construction of Fireproof Buildings or Parts of Same. W. H. James, Pimlico, Middlesex; C. Wallis, Walthamstow, Essex; and W. Mackinnon, Middlesex. Eng. Pat. 19,684, Sept. 16, 1898.

The claims embrace what are termed a fireproof substance and a fireproof composition. The former consists of slag or clinker from blast, glass, or other furnaces, and is to be used for such purposes as filling around of joists or between plaster walls. The composition consists of slag or clinker, lime, plaster, mastic, and cement, gauged with water as required. It is said to be applicable to a variety of purposes, such as for fireproofing, fixing bricks, in the construction of partition walls, as an ingredient in concrete and mortar, for making artificial stone, casing ironwork, &c. —H. H. B. S.

Artificial Stone, Impts in. F. Gehre, Coblenz, Germany. Eng. Pat. 6311, March 23, 1899.

To any of the following bodies or any combination of them, *viz.*, boracite, stassfurtite, borate of magnesia, or their respective residues left after the separation of the boron or hydraulic magnesia, is added 15 to 25 per cent. of powdered calcspar. To the dry mixture is then added 30 to 45 per cent. of a solution of either, or any combination, of chlorides such as those of the following metals, *viz.*, zinc, aluminium, ammonium, magnesium, &c. Further, about 10 per cent. of paper fibre is added as a filling. Artificial stone prepared of these materials is said to be more weather-resisting than that made with magnesite.—H. H. B. S.

Bricks and Analogous Articles, Impts. in the Manufacture of, from Lime and Sand, and in Means and Appliances for effecting the same. L. Galecki, J. Lopatin, and P. Lopatin, all of Warsaw. Eng. Pat. 7247, April 6, 1899.

A mixture of freshly slaked lime, carbonate of soda asphalt tar, and sand is worked into a homogeneous mass, and moulded into bricks under high pressure. These are then passed in rotation through three ovens or chambers, communicating with each other by means of a tramway. In the first chamber the bricks are dried at a low temperature, in the second they are subjected to the action of carbonic acid gas under pressure produced by superheated steam, and in the third they are dried at a temperature of 100° C. In the final drying, bisilicate of soda is said to be produced.—H. H. B. S.

Bricks, Building Blocks and Ore Briquettes, Process for the Manufacture of. H. Rensing, Dorsten, Westphalia. Eng. Pat. 7878, April 14, 1899.

Quick lime is first slaked with an insufficient quantity of water, by which an extremely fine powder is obtained, and this is then mixed with sand, slate, ashes, or similar material. The dry mixture having been gauged with water is moulded as required, and the moulded articles are then subjected to the action of steam under pressure, which results in the formation of silicate of lime. The addition of finely divided ore or "furnace dust" to the other ingredients is also claimed.—H. H. B. S.

X.—METALLURGY.

Steel, Martin-, Impt. of. C. Caspar. Stahl u. Eisen, 1899, **19**, 227.

Martin steel is improved by running it from the casting ladle into pre-heated crucibles, which after being filled to the brim are left quietly standing for an hour in crucible furnaces before pouring. In this way the steel loses its gases, and yields denser and more uniform ingots. For this purpose a pure ingot iron may be recarburised, either by the Darby process before pouring into the crucible, or by running it into pure highly carburised pig-iron already melted in the crucible. It is doubtful, however, if such a steel can be considered crucible steel. Instead of this, a basic converter or Martin hearth may be used in conjunction with an acid Martin furnace with a short narrow but deep hearth; the fluid iron is run into the latter (while the basic slag is held back) and there comes in contact with a pre-determined quantity of pure pig-iron and ferro-silicon melted at a very high temperature under a cover of neutral slag. The metal thus becomes carburised and thoroughly mixed, and after 40 minutes is ready for pouring. —W. G. M.

Steels, The Effect of Low Temperatures on. F. Osmond. Comptes. Rend. **128**, [23], 1395—1398.

In 1890, Hopkinson described a nickel-steel, containing 25 per cent. of nickel, non-magnetic at the ordinary temperature, but becoming magnetic when immersed in liquid air, and then remaining so up to 580° C.; at the same time its hardness increased, and its electric resistance and density diminished. Dewar and Fleming found the same to be the case with a steel prepared by Hadfield, containing 29·07 of nickel, 0·14 of carbon, and 0·86 of manganese. The author has verified this, and finds in addition that a steel containing 0·59 of carbon, 5·90 of manganese, and only 3·77 of nickel behaves in a similar way. Further, an ordinary cementation steel (1·4 to 1·6 carbon), when heated to 1050° C. and plunged into ice-water, is seen to consist of two components, one hard, the other milder, like a manganese or nickel steel. When this is plunged into liquid air, it undergoes the same sort of change as the nickel and manganese steels referred to above; and if one surface be polished before immersion, the polish disappears, through the mild constituent, the volume of which increases, becoming elevated in relief. The author suggests that the addition to iron of nickel, manganese, or carbon (and possibly also of chromium or tungsten) lowers the temperature of transformation during cooling; so that while pure iron has assumed the magnetic character at the ordinary temperature, a steel containing a certain proportion of these other substances remains non-magnetic at that temperature, but can be rendered magnetic if the cooling be carried so much farther as corresponds to a bath of liquid air; and by adding a still greater amount of the modifying substances, a steel can be produced (like Hadfield's steel with 13 per cent. of manganese, and certain nickel-chrome steels described by Guillaume) which remains non-magnetic even when cooled in liquid air. We have here a phenomenon analogous to the lowering of the freezing point of a solvent by a dissolved substance.—J. T. D.

Metallic Tungsten. A. Stavenhagen. Ber. **32**, [9], 1513—1516.

Metallic tungsten seems never to have been prepared in a fused state. The author attempted to prepare it by reducing pure tungstic acid with aluminium powder; the two were intimately mixed, and the mixture fired in a crucible, when violent action occurred, much of the mixture being blown out. From the mass of corundum in the crucible was extracted, however, only a cindery mass of semi-fused tungsten, which analysis showed to contain 2·6 per cent. of aluminium. The reaction was found to be more manageable when aluminium filings were used, but the result was the same; nor was a fused metal obtained, however great an excess of aluminium was employed. It was found, however, that excess of aluminium in the mixture did not increase the proportion of that metal in the tungsten, but that the higher the temperature reached in the reaction, the more nearly pure was the tungsten obtained.

When, however, immediately on the completion of the action, more aluminium filings were poured on top of the hot melt, and there was directed on them first the flame of the oxyhydrogen blowpipe and afterwards a stream of pure oxygen, a much higher temperature was reached than before; and after cooling there was recovered from the melt a mass of compact fused tungsten, showing a crystalline fracture, little darker than zinc in colour, hard enough to cut glass, of density 16·6, not melted by the oxyhydrogen flame, not attacked by acids or aqua regia, but slowly dissolved by melted caustic alkalis. In two samples thus prepared there was found no aluminium, in another only 0·5 per cent. In the electric furnace this metal showed a mere surface melting, which was very probably due to a surface formation of carbide. The author is continuing his work.—J. T. D.

Blast Furnace Problem with Zinc. W. W. Taylor. Cleveland Iron Trade Review, March 30, 1899; through Eng. and Mining J., 1899, **67**, [16], 469.

The iron ores of the Oriskany period, mined and smelted in the Western Counties of Old Virginia, give trouble owing to the 0·1 per cent. of zinc which they contain. Part of the zinc is deposited as zinc oxide in the stoves and flues, but the bulk remains, forming accretions of "cadmia," containing metallic Zn = 73, SiO_2 = 2·5, and FeO and Al_2O_3 = 3 per cent., which accumulate on the furnace walls. The zinc trouble was scarcely known in the old days and is the result of the rapid driving and low fuel consumption now adopted. The accretion forms, for example, as shown in Figs. 1 and 2, opposite the gas flue, and in time seriously affects the regularity of driving by altering the distribution of the charge from the bell, as shown in Fig. 2; fine portions accumulate at *c*, while rounded pieces roll first to *a*, and then to *b*. The result is that the furnace drives harder on the *b* side than elsewhere, and the masonry there tends to be burnt out. The ring of zinc sometimes weighs as much as 60 tons, and the chief trouble lies in the danger of it becoming detached by the continual dropping upon it of the charges from the bell. Falling in front of the tuyères it has there the effect of a block of ice, the iron at once becomes white and silvery, or perhaps the furnace stops making iron altogether for a time, and metallic zinc may flow out with the cinder or escape from around a tuyère. A heavy coke blank must now be run and in a few hours the trouble will be practically over. When a central flue is used, the accretion forms as shown in Fig. 3; this may be cut away and removed in sections from time to time, as is done in the Longdale furnaces after charging a few barrows of wet ore when the furnace has been banked. It is suggested that the accretions would be smaller and more easily removed if the furnace were built with several lateral flues as shown in Fig. 4.—W. G. M.

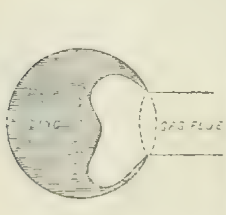


Fig 1

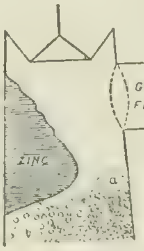


Fig. 2.

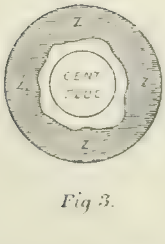


Fig 3.

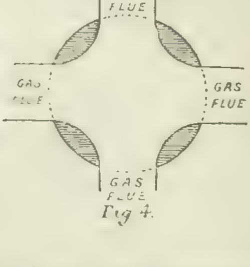


Fig 4.

Aluminium, Impurities of. A. Minet. Comptes Rend. 1899, **128**, [19], 1163—1167.

The impurities of aluminium produced by the electrolytic method are chiefly silicon, iron, and traces of carbon. With improvements in apparatus and purity of materials, these impurities have been reduced from 1·2 per cent. in 1890 to 0·14 per cent. in 1897, the greater part of the decrease being in the proportion of silicon. The silicon is derived from the raw materials and from the electrodes, and these have undergone improvements as regards their purity, whilst the iron is derived principally from the iron melting vessels. The author describes three types of plant designed to reduce the contamination with iron to a minimum. Type I.—The bath is kept in fusion partly by the current and partly by external heat. The melting vessel is of cast iron, with parallel sides surrounded by masonry, outside which the hot gases of a furnace circulate. The two electrodes, which are of carbon, dip into the pot, and the cathode is placed immediately over a carbon box in which the aluminium is collected. This type however has the disadvantage that owing to the formation of a fusible iron-aluminium alloy on the inside and the action of the furnace outside, the iron pots do not last much longer than a week. Type II.—The bath is kept in fusion by the heat of the current alone. The iron pot is of the same form as the first, but is bare outside and lined with a layer of carbon inside. The anode dips into the bath, and the sides of the vessel form the cathode. The metal collects at the bottom, and is withdrawn by means of a plugged hole. At first the proportion of iron in the aluminium is very small, 0·1—0·2 per cent., but the high temperature employed, allows the molten mass to filter through the carbon lining with the deposition of aluminium on the iron and of a certain amount of sodium, which is liable to corrode and disintegrate the carbon of the lining and to allow increasing contamination of the metal with iron. If alloys are to be made, this type is very suitable, the vessel being made of the metal with which the aluminium is to be alloyed. Type III.—The bath is heated by the current alone, and the melting vessel is similar to type II., with an extra thick carbon lining. The two electrodes dip into the bath, and the vessel is not subjected to any electrical action. It is consequently more durable, and can be cooled on the outside, so that, whilst the temperature of the bath in fusion may be 750° C., the metal pot can be kept as low as 500° C., and in this case it can be made of pure aluminium, contamination by penetration of the lining being thereby avoided.—J. F. B.

Potash and Soda Salts from the Natural Decomposition of Lead Slags. M. W. Iles and C. F. Shelby. Eng. and Mining J. June 3, 1899, 650.

The authors have examined a greyish-white efflorescent salt, soluble in water, which had formed at and near the bottom of the slag dump at a lead-smelting works in Denver, Colo. The salt, which is frequently tinged with brown or red, is more noticeable on the older and more weathered portions of the slag dump. Analysis of the salt gave the following figures:—SO_3, 48·45; K_2O, 28·44; Na_2O, 13·48; CaO, 1·80; MgO, 1·08; Fe_2O_3, 0·29; MnO, 0·26; Cl, 0·47; and loss on ignition, 2·40 per cent. The composition of the compound is probably—Potassium sulphate, 52·64; sodium sulphate, 29·97; sodium chloride, 0·77; calcium sulphate, 4·37; magnesium sulphate, 3·24; ferric sulphate, 0·73; manganous sulphate, 0·56; sulphuric anhydride in combination with other bases, 1·89; loss on ignition, 2·40 per cent. The authors put forward the suggestion as to whether, in the future, the old slag dumps of the lead smelters may not be used as a source of the valuable potash salts.—A. S.

Platinoid Metals, Some Alloys of. F. Rössler. Chem. Zeit. **23**, [41], 438.

From the alloys prepared by fusing bismuth or antimony with 2 per cent. of platinum or palladium, crystals of $PtBi_2$, $PtSb_2$, $PdBi_2$, or $PdSb_2$, respectively, can be obtained by treating the mass with dilute nitric acid (with an addition of tartaric acid in the case of antimony). $PtAs_2$ has also been obtained from the waste products of platinum recovery, by extracting the mass with cold nitrohydrochloric acid.

On extracting rhodium-bismuth alloys (5 per cent. Rh) with dilute nitric acid, $RhBi_4$ is obtained, which is entirely soluble in nitrohydrochloric acid or concentrated nitric acid.

The gold-rhodium compound in alloys of these two metals could not be isolated, rhodium being left behind on treatment with nitrohydrochloric acid; a small portion of this metal taken up by the acid was deposited as crystals on cooling.—C. S.

Chlorination at the Utica Mine. T. N. Smith. Eng. and Mining J. 1899, **67**, [16], 467—468.

When the roasted ore is cool, 12½ lb. of sulphuric acid and 12 per cent. of water are added, and, after mixing, the mass is shovelled into a heap in front of the leaching tubs, which are of pine, with 2 in. staves and bottom, 8 ft. 6 ins. in diameter, and 3ft. 6 ins. in height, four being provided for each oven. Each tub has a false bottom and a gravel and sand filter. The roasted ore is sifted in through a screen with nine meshes to the square inch until it uniformly fills the whole tub; the top is then luted on, and chlorine is introduced at the bottom until the gases escaping from a hole in the cover give thick white fumes with ammonia gas. This requires about six to eight hours. The whole is then left, charged with gas, for 48 hours. The tub is now filled with water, which is drawn off after standing for an hour, fresh water being introduced above to take its place. The leachings are collected in a vat 4 ft. high by 8 ft. in diameter, and when this is full, if the liquor coming off shows no sign of gold on testing with ferrous sulphate, the tub is left standing until the next morning, when another ton of solution is run off, and the leaching is finished. To the gold solution from one tub are added 15 lb. of sulphuric acid to precipitate lead and lime, and the liquor is then run into the precipitating vats, where the gold is precipitated by ferrous sulphate. The $FeSO_4$ solution is added until coloration is no longer produced after stirring, and the whole is allowed to rest for 48 hours. 1 oz. of barium chloride dissolved in water is now sprayed on to the top of the solution, and forms (with the sulphuric acid present in the liquid) barium sulphate, which sinks to the bottom and carries with it gold which otherwise would have remained in suspension. The clear liquor is then run off, but the gold is left on the bottom, where it accumulates from successive charges until the clean-up takes place. In cleaning up, the gold from the different tubs is filtered, dried, melted with borax, toughened with mercuric chloride, and run into bars 0·997 fine. The extraction from poor concentrates is 90 per cent.

Formerly the chlorine for the charges from each oven was generated from 90 lb. of manganese dioxide, 100 lb. of salt, and 200 lb. of sulphuric acid. Now liquid chlorine is used, drums 10 ins. in diameter and 5 ft. in length, holding 115 lb. of liquid chlorine compressed at a pressure of 200 lb., are used. One drum suffices to treat 50 tons of concentrates, although 72 tons may sometimes be treated by this amount. The cost per ton of ore treated worked out to 7·80 dols. with chlorine gas generated on the spot and to 6·90 dols. with liquid chlorine. An analysis of the cost is given for each method.—W. G. M.

Silicon and Copper Silicide. O. J. Steinhart. Eng. and Mining J. 1899, **67**, [24], 710.

Silicon and copper silicides being now manufactured in Germany and the United States by an electrical process, can be obtained in considerable quantities at a comparatively reasonable price.

Silicon is made in solid ingots, which may be added to a mass of molten metal without burning or deflagrating on the surface, like the crystalline product hitherto available. The chief uses of silicon are as follows:—

(1.) The addition of a small percentage of silicon is advantageous whenever dense and easily machined iron castings are required, and generally in all cases when making high grade, delicate castings. The silicon promotes the formation of graphitic carbon, and shrinkage is therefore, to a large extent, avoided, as the graphite which separates coats the iron and does not take part in the shrinkage. The formation of blowholes, due to the absorption of gases, is also, to a certain degree, avoided.

(2.) In the case of steel castings containing very low percentages of carbon, the addition of silicon is much better than that of ferrosilicon or ferromanganese, as with the first named, any oxygen compounds are reduced without increasing the percentage of carbon in the steel. Metallic silicon has been employed in the Wallrand-Legenisel process for overheating the steel in a small Bessemer converter; sluggish charges are easily rendered fluid in this way. The addition of silicon is also beneficial in making open-hearth and crucible as well as tool steel castings.

Silicides of copper, containing respectively 10, 15, and 30—35 per cent. of silicon, are prepared in the form of ingots weighing from 15 to 18 lb. Copper silicide may be used as follows:—

(1.) It may be employed in place of copper phosphide as a purifying and deoxidising agent; it acts as a reducing agent in presence of the oxygen compounds of arsenic and antimony, and thereby counteracts their deleterious effects. The resulting metals combine with the metallic copper, but the silicon does not enter into combination with the same. If copper, therefore, be finally refined with copper silicide, it acquires greater strength and toughness.

(2.) Silicon may be added to copper in such a manner that it forms a definite compound with the latter, thereby adding materially to its hardness and strength, which, it is stated, can be made equal to that of steel if a sufficient quantity of silicon be added. In the following table the relative conductivity and tensile strength of these alloys and of pure copper are given:—

—	Tensile Strength per 1 sq. mm.	Conductivity.
	Kilos.	
Pure copper wire	28–35	100
Cu with 0·02–0·05 per cent. Si	45	98
„ 0·05–1·1 per cent., Si., and 1·1 per cent. Sn.	83	43
„ 0·5 per cent. Si	50	28
„ 3·5 per cent. Si	95	7

These alloys are particularly suitable in all cases where high tensile strength and small elongation are required and the use of iron is not admissible, as well as in all cases where acid-resisting material is required.

(3.) Copper silicide may be added to tin and zinc bronzes in place of copper phosphide. The bronzes obtained in this way are very elastic and heat-resisting, whilst much less silicide is required than the corresponding phosphide. The purifying power of 10 per cent. copper silicide as compared to the same strength phosphide is as 1·48 : 1.

(4.) The addition of copper silicide to aluminium bronzes is of great importance; alloys can be obtained of high tensile strength, and ranging, with respect to their hardness, from ordinary brass to the hardest phosphor bronze. As a rule, the presence of silicon in aluminium bronzes increases their strength and hardness and reduces their elongation.

—A. S.

Nitric Acid, Action of Metals on. P. C. Freer and G. O. Higley. Amer. Chem. J. 1899, **21**, [5], 377—392.

In previous articles (Amer. Chem. J. **15**, 71; **17**, 18; and **18**, 587; this Journal, 1893, 601; 1895, 661) the results are given of experiments made to determine the nature of the action between nitric acid and copper, lead, and silver. Further experiments have now been carried out with iron in the form of piano wire, the methods followed being similar to those already described (*loc. cit.*). Experiments were also made on the electrolysis of nitric acid and on the action of electrolytic hydrogen on the acid. The following conclusions were arrived at :—

(1.) Silver, copper, iron, and electrolytic hydrogen have almost the same effect on concentrated nitric acid, nearly pure nitrogen dioxide being evolved.

(2.) In regard to their action on dilute nitric acid, the order of the metals, silver, copper, lead, and iron is that of the potential series.

(3.) The activity of electrolytic hydrogen depends, in a marked degree, upon the character of the electrode upon whose surface it is liberated.

(4.) Electrolytic hydrogen, in contact with cathodes of copper and of silver, effects reduction of nitric acid in proportion to the current density.

(5.) If nitric acid (sp. gr. 1·05) be subjected to electrolysis in cells with cathodes of silver and lead respectively, on the surface of which cathodes there is equal current density, the reduction products are the same, *i.e.*, nitrogen and ammonia, in approximately the same proportions.

(6.) If silver and lead be dissolved in nitric acid (sp. gr. 1·05), the reduction products are widely different, both qualitatively and quantitatively ; with the silver, nitric oxide and nitrogen dioxide are obtained equivalent respectively to 95 per cent. and 5 per cent. of the metal dissolved, whilst with lead, nitric oxide, nitrogen dioxide, and nitrous oxide are obtained equivalent respectively to "2·5, 7·5, and 70 per cent. of metal dissolved."

(7.) Lead reduces nitric acid (sp. gr. 1·05) much more completely than copper, yielding about five times more nitrous oxide than the latter ; but when used as cathode in an electrolytic cell, copper has a much greater "energising" effect upon the hydrogen deposited upon its surface than is shown by lead under the same circumstances, and produces about three times as much ammonia as the latter.

(8.) From the results obtained, the authors conclude that with concentrated nitric acid, the products formed when metals are dissolved in the acid are due to the action of the metals alone, but with dilute acid, both metals and hydrogen unite in causing reduction.—A. S.

Lead-Tin and Lead-Antimony Alloys, Quick Testing of. J. Richards. Journ. Franklin Inst. **147**, [5], 398.

See under XXIII., *page* 710.

Nickel, Colorimetric Estimation of. M. Lucas. Bull. Soc. Chim. 1899, **21**, [9], 432.

See under XXIII. *page* 709.

Cyanides, Estimation of Sulphides in. J. Loevy. J. of the Chem. and Metallurg. Soc. of Sth. Africa, 1899, **2**, 54.

See under XXIII., *page* 710.

Copper, Analysis of the Deposit Separated during the Electrolytic Purification of. A. Hollard. Ann. Chim. anal. appl. **4**, 123 ; Chem. Centr. 1899, **1**, [19], 1082.

See under XXIII., *page* 710.

PATENTS.

Metal or other Surfaces, Protection and Preservation of ; An Improved Composition for the. H. F. Clough, A. Turner, and J. Turner, Southport. Eng. Pat. 13,931, June 23, 1898.

The composition claimed is prepared by adding melted tallow (say 100 parts) to a solution of caustic soda (15 parts) in water, and mixing the liquid with a solution of alum (say 160 parts). The resulting precipitate is "dissolved or liquefied" in a suitable proportion of turpentine (say 1 : 20).

It is stated that this composition protects metallic or other surfaces from the action of moisture without altering their appearance.—C. A. M.

Gold Leaf Waste, Improved Composition for Use in Collecting or Saving of. H. H. Lake, London. From F. H. Lewis, New Haven, U.S.A. Eng. Pat. 7607, April 11, 1899.

The waste gold leaf is picked up by a wad that contains a composition made of crude rubber, kerosene oil, and oil of benzoin.—S. K.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Conductivity of Aqueous Solutions containing Potassium and Sodium Sulphates, Calculation of the. E. H. Archibald. Trans. Nova Scotian Inst. Science, 1897—98, **9**, 291—301.

According to the dissociation theory the conductivity of a mixture of two solutions of electrolytes, 1 and 2, which have one ion in common, and which contain n_1 and n_2 grm. equivalents per unit of volume, is given by the expression :—

$$k = \frac{1}{p\,(v_1 + v_2)}(\alpha_1\, n_1\, v_1\, \mu_{\infty 1} + \alpha_2\, n_2\, v_2\, \mu_{\infty 2})$$

where the α's represent the ionisation coefficients of the electrolytes in the mixture, the n's the concentrations of the constituent solutions (in grm. equiv. per litre), the v's the volumes of the constituent solutions, the μ_∞'s the specific molecular conductivities (*i.e.* per grm. equiv.) at infinite dilution, of the electrolytes in the mixture, and p the ratio of the volume of the mixture to the sum of the volumes of the constituent solutions.

The author has made careful experiments to test the accuracy of the above formula, and has found that for mixtures of solutions of potassium and sodium sulphates not more concentrated than 0·8 equiv. grm. molecules per litre, it is possible to calculate the conductivity within, or but little beyond, the limit of the error of observation, *viz.*, about 0·25 per cent.—J. S.

Conductivity of Aqueous Solutions containing the Double Sulphate of Copper and Potassium, and of Equimolecular Solutions of Zinc and Copper Sulphates, Calculation of the. E. H. Archibald. Trans. Nova Scotian Inst. Science, 1897-98, **9**, 307—320.

The conductivities of these solutions were calculated in the same way as in the preceding paper, and for very dilute solutions gave correct results. Above a concentration of 0·1 grm. mols. per litre, discrepancies amounting to over 6 per cent. were observed in the case of potassium copper sulphate solutions. These are ascribed by the author to the fact that in the more concentrated solutions the molecules of the double salt are not entirely broken up into the simpler molecules.—J. S.

Conductivity of Aqueous Solutions containing the Chlorides of Sodium and Barium, Calculation of the. T. C. McKay. Trans. Nova Scotian Inst. Science, 1897-98, **9**, 321—334.

The formula given above enables the conductivities of these solutions to be correctly calculated so long as the concentrations do not exceed 2 grm. equivalents per litre.—J. S.

Conductivity of Aqueous Solutions of Potassium-Magnesium Sulphate, Calculation of the. T. C. McKay. Trans. Nova Scotian Inst. Science, 1897-98, **9**, 348—355.

The electrical conductivity of solutions of potassium magnesium sulphate indicates that in dilute solutions the double salt entirely splits up, whilst in strong solutions the two component salts are at least partially united.—J. S.

Hydrochloric Acid, Electrolysis of. Haber and Grindberg. Zeits. anorgan. Chem. **16** 198—228, 329—361 and 438—449 ; through Zeits. für Elektrochem. **5**, 557—560.

In the first paper the authors deal with the phenomena which occur at the anode during the electrolysis of hydrochloric acid with bright platinum electrodes at the ordinary temperature. The subject is discussed from the theoretical standpoint and the practical results regarding the yields of the different products are summarised as follows :—

In concentrated acid the yield of chlorine at the anode amounts to 100 per cent., whilst on dilution the yield falls off and may even decrease to a very low percentage. Traces of hypochlorous acid occur in the anode gas during the electrolysis of dilute acid. The yield of chloric acid amounts to about one-third of the theoretical quantity when the strength of the acid is between normal and one-third normal, and this is accompanied by small quantities of hydrogen peroxide. In the most dilute acid the yields of perchloric acid and oxygen were respectively about one-fourth of the theoretical quantity and 40 per cent.

In the second paper the authors discuss the effect of replacing a portion of the hydrogen of the hydrochloric acid by a metal and the effects of increase of temperature and of platinised electrodes. At an increased temperature it was found that the yield of chloric acid diminishes, which agrees with Oettl's result, viz., that more hypochlorite is formed at high temperatures at the expense of the chlorate.

Platinised electrodes act in the same general way, but constant results could not be obtained.

In the third communication the solvent action on platinum and other anodes is dealt with, and the results are given in the following table :—

Anode.	Electrolyte.	Temperature.	Current Density. Amp. per sq. cm.	Per Cent.
Platinum	36 % HCl	10—12	1	0·3
,, ...	30 ,,	16·5—18·3	2	0
,, ...	25 ,,	48·1—52·3	2	0·06
,, ...	25 ,,	57—60	1	1·8
,, ...	32 ,,	48—52	1	4·16
,, ...	32 ,,	60—70	1	5·2
,, ...	8 ,,	100	1	0
,, ...	11 ,,	90—95	1	0·1
,, ...	16 ,,	94—97	1	1·7
,, ...	20 % NaCl	99—105	1	0
,, ...	Satd. ,,	105—106	1	0
,, ...	,, ,,	Boiling.	2	0·05
Platinum + 10 per cent. iridium.	37 % HCl	17	1	0
,, ,,	32 ,,	48—52·5	1	0·5
,, ,,	32 ,,	68—70	1	0·9
,, ,,	25 ,,	68—70	1	0
Platinum + 25 per cent. iridium.	37 ,,	17	1	0
,, ,,	32 ,,	52—53	1	0
,, ,,	32 ,,	68—75	1	0

The last column of the table gives the percentage amount of platinum dissolved compared with what should have been dissolved according to Faraday's Law (1 amp. hour = 1·814 grm. Pt.), or, in other words, the fraction of the current which has exerted its solvent action on the anode.

The formation of platinum black on the cathode is not considered by the authors to be an electrolytic deposit, but rather due to a mechanical action, and they suggest that metals (lead included) have a tendency to increase their surface in order to reduce the current density.—J. S.

PATENTS.

Electrolysis of Liquids and Apparatus therefor; Impts. in or relating to the. W. P. Thompson, London. From M. Hazard-Flamand, Boulogne-sur-Seine, France. Eng. Pat. 12,765, June 7, 1898.

Apparatus is shown for the production of oxygen and hydrogen and other gases by electrolysis of alkaline solutions. "A device for obtaining gases by electrolysis free from admixture, the said gases being so separated from the moment of their production onwards, that no gas disengaged from one electrode can possibly become mixed with that from the other, even if differences of level and of pressure occur in the apparatus."

The electrodes are separated by "an annular gas-tight diaphragm having liquid sealed apertures."—J. C. R.

Ozone; Impts. in and relating to [Electrical] Means for Producing. E. Böhm, London. Eng. Pat. 14,450, June 30, 1898.

Glass bulbs or beads lined with metal are threaded together on conducting wires. These strings of beads are connected electrically with an induction coil, or other suitable source of electricity, and are arranged in layers in a closed insulating box, of the kind usually employed in ozonisers. The layers of beads may be separated by sheets of metal, carbon, or other suitable material, perforated, or otherwise, in which case the sheets will be connected to one pole of the induction coil, and the wires of the metal-lined beads to the opposite pole. In the absence of dividing plates or sheets, however, the alternate layers of metal-lined glass beads are connected to the opposite poles. Previous patents, Nos. 615 and 7177 of 1897 (this Journal, 1898, 159; 252).—J. C. R.

Thermo-Electric Batteries or Piles, Impts. in. J. Matthias, Stuttgart, Germany. Eng. Pat. 7527, April 10, 1899.

In the couple consisting of German silver on the one side, and on the other of an alloy composed of 2 parts of antimony and 1 part of zinc, the first electrode is hard, whereas the second has the disadvantage of greater fragility. The present invention consists in giving support and greater firmness to the fragile electrode, reducing the resistance to a minimum, uniting the separate elements in very large numbers in a relatively small space, and permitting an intense cooling action being applied to the side of the electrode farthest from the source of heat.—J. C. R.

(*B.*)—ELECTRO-METALLURGY.

Aluminium, Behaviour of, in Presence of Various Electrolytes. F. E. Polzenius. Chem. Zeit. **23**, [41], 438—439.

The author finds that mineral acids are ill adapted for shaping aluminium for current transformers, saline solutions being better, and organic acids or salts best of all. A plate shaped in sulphuric acid gave a resistance of 20 volts, but in phosphoric acid and silicic acid up to 120 volts can be obtained. Phosphates and silicates have the strongest effect of all inorganic salts. When potassium bichromate was employed, the tension went up to 80 volts, and the plate became covered with small sparks.

In the case of organic compounds, a peculiar ratio exists between the tension, the size of the molecule, and the number of hydroxyl and carboxyl groups; glycerin and sugar giving a tension of 40—50 volts resistance, benzoic acid, nil. In tartaric and citric acids, the aluminium anode opposes a resistance of 500 volts, and luminous effects are produced.

The practical value of the aluminium current-transformer has been proved in the Pollak accumulator works (Frankfort).—C. S.

PATENT.

Electrolytic Extraction of Zinc, and other Metals from Ores or Waste containing them; A Process for the. J. C. Fell, London. From W. Strzoda, Zalenze, Germany. Eng. Pat. 24,307, Nov. 17, 1898.

"A process for the electrolytic extraction of zinc from their ores or waste containing them, in which the pulverised ore, such as calamine, blende, and the like, or waste containing zinc, such as zinc ash and so forth, is exposed to the action of an electric current directly in an alkaline bath (caustic soda), without any preliminary chemical treatment, whereby the zinc and also the other metals present are at once in such bath metallically separated at the cathode."

—J. C. R.

XII.—FATS, OILS, AND SOAP.

Colloidal Salts, The Boiling Point of Aqueous Solutions of; and the Determination of the Molecular Weight of Soaps. F. Krafft. Ber. 1899, **32**, [9], 1584—1596.

The author here brings forward further evidence in support of his theory that the sodium salts of the higher fatty acids behave, according to the conditions, like crystalloids or colloids. He describes experiments made with pure sodium palmitate, sodium erucate, and sodium oleate, which show that when these are dissolved in water in not too concentrated a solution, the boiling point of the water is not raised to any appreciable extent. On adding a crystalloid salt such as sodium chloride or potassium bromide to the solution, the boiling point of the liquid is raised to the same extent as that of a pure aqueous solution of the salt, and the molecular weight of the crystalloid can be calculated in the usual manner from the result. If, however, gelatinisation of the soap solution occur, or if the soap be salted out, the steam gives up so much heat to the soap membranes whilst forcing its way through them, that the rise in temperature caused by the crystalloid salt disappears. This was found to be especially the case with solutions of potassium stearate, and it was necessary to use only moderately concentrated solutions, in order to obtain the correct boiling point on the addition of the crystallised salt.

It is well known that soaps are not decomposed by alcohol as by water, and this fact may be made use of for the determination of their molecular weight. If the alcohol used contain water, the molecular weights, calculated from the boiling point of the solution, have, according to the author, no real significance, the soaps being present in an incomplete colloidal condition (*c.f.* this Journal, 1896, 601). By using perfectly anhydrous alcohol, however, the molecular weights of anhydrous soaps determined by this method agree with those calculated from their formulæ.

Thus, potassium acetate (molecular weight 98·18) gave the following results :—

Alcohol.	Potassium Acetate.	Elevation of Boiling Point.	Calculated Molecular Weight.
Grms.	Grms.	° C.	
19·04	0·3586	0·232	93·3
19·04	0·7229	0·430	94·9
19·04	1·1755	0·734	96·7

With the other pure salts examined, the following results were obtained :—Potassium heptylate, $C_7H_{13}O_2K$ (168·28), found 153·7 to 156·5 ; sodium laurate, $C_{12}H_{23}O_2Na$ (222·3), found 237·2 ; sodium myristate, $C_{14}H_{27}O_2Na$ (250·3), found 253 ; sodium palmitate, $C_{16}H_{31}O_2Na$ (278·4), found 286 ; sodium oleate, $C_{18}H_{33}O_2Na$ (304·4), found 301·3 to 345·9 ; potassium oleate, $C_{18}H_{33}O_2K$ (320), found 347.

From these results the author concludes that soaps dissolve with difficulty in absolute alcohol, but in the main without undergoing any decomposition. On the other hand, they are readily soluble in hot water, but are simultaneously decomposed into their components.—C. A. M.

Colloidal Salt Solutions, The Conditions of the Crystallisation of. F. Krafft. Ber. 1899, 32, [9], 1596—1608.

In former communications on this subject (this Journal, 1894, 1207 ; and 1896, 206 and 601), the author propounded the theory that colloidal liquids or solutions contain the liquefied substance in a molecular state, and supplemented this by a second theory that the liquefied molecules of colloidal substances rotate in very small closed paths, so that they form parts of a system. From this the conclusion is arrived at that the several parts of such a liquid system have a definite structural relation to each other, and, so long as the conditions remain constant, come periodically into the same relative position.

The author considers that the change of colloidal substances or liquids into the crystalline state is not opposed to this theory, since it is due simply to the cessation or alteration of the movement or relative position of the molecules. Moreover, in his opinion, when a colloidal substance in solution becomes "gelatinous," or a melted homogeneous body solidifies in an "amorphous" condition, the movements of the molecules become exceedingly slow, but there is still a definite structure, which although differing from the arrangement of the molecules in a crystal, may yet be compared with it, and be termed "globomorphous" rather than "amorphous."

The ready solubility of soaps and other salts in water may be regarded as dependent on the readiness with which they undergo hydrolytic decomposition, or, in other words, show a capacity for forming hydrates, or bodies containing hydroxyl. Thus, in the solution of sodium stearate in water, the author believes the principal change which takes place to be a decomposition of the salt into stearic acid and sodium hydroxide as in the equation—

$$C_{18}H_{35}O_2Na + H_2O = C_{18}H_{35}O_2H + NaOH.$$

In this decomposition it is assumed that so long as a large excess of water is avoided, the relation between the electro-positive and electro-negative decomposition products is not disturbed, since otherwise hot concentrated solutions of sodium stearate would not be clear and practically neutral in reaction. But that such a decomposition does take place is, in the author's opinion, the only way of accounting for the fact that sodium stearate, which melts with decomposition when heated to 260° C., has almost the same melting point as free stearic acid (69° C.), when heated in the presence of a little water.

In the author's opinion this view received confirmation by the results of a series of experiments with the pure sodium salts of various fatty acids. Concentrated solutions were prepared with these, and their solidification point determined. The soap solutions were prepared by slowly warming the sodium salts with the required amount of water, at a temperature a little higher than that of the melting point of the free fatty acid present. They were then cooled very gradually in the water-bath, with occasional agitation, whilst the formation of froth was carefully avoided. In each case the temperature at which the "globomorphous" mass was formed was invariably lower than that of the melting point of the fatty acid. Thus, sodium stearate (m.p. about 260° C.) prepared from stearic acid (m.p. 69·4) "crystallised" from a 20 per cent. solution at 69° C.; from a 15 per cent. solution at 68° C., and from a 1 per cent. solution at 60° C. Sodium palmitate from palmitic acid (m.p. 62° C.) "crystallised" from a 20 per cent. solution at 62° to 61·8° C., and from a 1 per cent. solution at 45° C. Sodium myristate from myristic acid (m.p. 53·8°) "crystallised" from a 20 per cent. solution at 53° to 52° C., and from a 1 per cent. solution at 31·5° C.

Similar phenomena were observed in the case of sodium salts of unsaturated fatty acids, such as sodium oleate, sodium elaidate, and sodium erucate, although a long time (often days in the case of dilute solutions) was required for the complete separation of the salt.

The author's explanation is that when the fatty acid molecules in a soap solution are cooled below the melting point of the free fatty acid, they again acquire the capacity of the polar attraction of the crystalline state, whilst the rotating alkali molecules also seem to become similarly endowed, so that the two components again combine and the salt separates out.

That the alkali plays a part in the phenomenon is shown by the fact that the "crystallisation" of potassium salts occurs with much less readiness than in the case of the sodium salts, a fact which the author explains by the greater attraction of potassium hydroxide for water. And conversely the insolubility of lithium soaps may be explained by the slight attraction of lithium hydroxide for water.

Experiments with other salts, such as *p*-toluidine hydrochloride, cumidine hydrochloride, aniline hydrochloride, and sodium benzoylacetate, gave analogous results, pointing to a decomposition of the components in the solution. This supports the author's theory, that the crystallisation temperature of salts, one of whose components (either acid or base) is a substance insoluble in water and not readily forming a hydrate, approaches approximately the solidification temperature of the individual constituents.

When the crystallisation of salts occurs, there is a decomposition of the structural system in the solution ; but this decomposition is less marked, other conditions being equal, the lower the temperature of crystallisation. By means of an apparatus in which a small amount of the liquid could be slowly cooled, and the influence of dust and surface evaporation avoided, it was found that all salt solutions, given certain conditions, showed a tendency to the spheroidal form in their manner of crystallisation. For example, *p*-tolylhydrazine-hydrochloride, which in an ordinary cylinder crystallised at 58° C. from a 20 per cent. solution, could be cooled down to 35° C. in the supersaturation apparatus before separating from the same solution. It then crystallised in wart-like forms, which rapidly grew throughout the liquid.

From experiments of a similar nature to this, the author concludes that, even in the case of crystalloid salts, the separate constituents of the salts when in solution rotate in small, closed, and for the most part, spherical paths, and that there is therefore no essential difference in this particular between colloidal and crystalloidal salts.

—C. A. M.

Oleo-distearin, Melting Point of. R. Heise. Chem. Rev. Fett- u. Harz-Ind. **6**, [5], 91—93. (See also this Journal, 1899, 590.)

The author has examined a sample of the oleo-distearin prepared by Henriques and Künne, and as it is identical with that previously isolated by himself, concludes that the failure of these workers to observe the lower melting point (27°—28° C.) of the once melted substance was due to a difference in the conditions of experiment. He ascribes the occurrence of two melting points to allotropic modifications of the substance analogous to those met with in the case of sulphur and benzophenone. The following method for examining the oleo-distearin in this respect is recommended:—The sample of crystalline oleo-distearin should be melted and then cooled down rapidly until solidification sets in. On thereafter warming up the substance to 27° C. it will re-melt, and if heat be then applied more slowly, crystals will be observed to form, which in turn melt at 37°—38° C. This can be more clearly seen on a microscope slide under a power of 200 diameters. Again, by exposing two drops of the melted substance on a glass plate, one cooled slowly and the other rapidly by means of ice, and then warming the plate, the difference in melting point will become apparent.—C. S.

Proteïds, Solubility of, in Glycerin. H. Ritthausen. J. Prakt. Chem. 1899, **59**, [8—10], 479.

See under XVIII. A., *page* 701.

PATENT.

Fatty Bodies, Extraction and Decolorisation of; Process of and Apparatus for the. J. C. E. Bataille, Douai, France. Eng. Pat. 18,694, Aug. 31, 1898.

Claim is made for a process of extracting the material containing the oil by means of a solvent in a series of connected extractors. During the extraction, the substance is slightly heated by means of vertical pendant tubes which penetrate into the mass. These are of double construction, so that the steam may enter by the exterior tube and the condensed water be removed by the inner tube, or *vice versa*. When the contents of one extractor have been sufficiently washed, the solvent is driven forward into the next in the series by the pressure of the vapour produced on raising the temperature within the extractor to the boiling point of the solvent. The liquid still left in the material is then expelled by raising the temperature considerably and introducing low-pressure steam, which also dries the residue. The evaporated solvent is condensed and returned to the reservoir. This process is repeated in each extractor until the last of the series is reached, whence the solvent containing the extracted fat passes into another series of vessels of similar construction, but containing a decolorising substance such as pipe-clay. In order to effect complete decolorisation, the liquid is circulated in these by means of a pump, so as to bring it into thorough contact with the decolorising agent. Finally, the liquid passes through a canvas filter to an evaporator, where it is heated to a sufficient temperature to remove the solvent without affecting the oil.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

White Lead, Composition and Density of. E. Lenoble. Ann. Chim. anal. appl. **4**, 118—123. Chem. Centr. 1899, **1**, [21], 1140.

The author has analysed several samples of commercial white lead. The hygroscopic moisture was determined by drying at 100° C.; the carbon dioxide as loss of weight after addition of nitric acid; the lead oxide by ignition of 1 grm. of the sample; the acetic acid by distillation of 1 grm. with tartaric acid; the combined water by difference; and the density by the use of toluene. The formula $Pb(OH)_2.2PbCO_3$ was adopted, and, in the author's opinion, appears to represent white leads of the best kind. These appear to be the more suitable for use, the specifically lighter they are.—A. S.

Antimony Pentasulphide. O. Klenker. J. prakt. Chem. 1899, **59**, [8—10], 353—433.

In concluding his study of the action of hydrogen sulphide on pentavalent antimony compounds, the author states the following deductions:—The precipitates obtained from fairly strong alkaline solutions, contain no pentasulphide, but are mixtures of trisulphide and sulphur, the latter being extractible by carbon bisulphide. As the alkalinity is diminished, the trisulphide decreases and pentasulphide is formed in increasing quantities. A further increase of pentasulphide occurs in acid solutions, rising to a maximum in the presence of 12 per cent. of hydrochloric acid, when the extracted product retained 38·14 per cent. of sulphur. On increasing the acidity, the proportion of trisulphide increases, and in presence of 27·69 per cent. of free hydrochloric acid no more antimony is precipitated. Hydrochloric acid has a solvent action upon antimony pentasulphide, and the proportion of trisulphide in the presence of strongly acid solutions, rises with the time of contact. Contrary to the views hitherto held, the precipitate obtained on treating Schlippe's salt, Na_3SbS_4, with dilute acid is not the pentasulphide, but a mixture of the trisulphide and sulphur with variable quantities of the pentasulphide. The composition of the precipitate obtained by the action of hydrogen sulphide in acid solutions varies with the temperature, the acidity, and the time of contact; at 75° C. it is practically $Sb_2S_3 + 2S$. Hot carbon bisulphide and other solvents boiling below 100° C. bring about no perceptible decomposition of the pentasulphide. Since the precipitates obtained under all the various conditions tried by the author invariably contained the trisulphide, the existence of pure pentasulphide is highly doubtful, its actual preparation is only probable in acid solutions within narrow limits of temperature and concentration.—J. F. B.

Colours [White Lead] Ground with Oil, Determination of Water in. H. Forestier. Ann. Chim. anal. appl. **4**, 114. Chem. Centr. 1899, **1**, [21], 1138.

See under XXIII., *page* 712.

PATENT.

New Pigment or Paint, Improved. A. G. Brookes, London. From A. B. Kittson and A. B. Browne, Dorchester, U.S.A. Eng. Pat. 8499, April 12, 1898.

A non-crystalline, spongy, friable, magnetic oxide of iron is prepared by reducing peroxide of iron in a revolving chamber, by means of carbon monoxide or other reducing gas. To obtain different shades, baryta, zinc white, chrome yellow, &c., might be ground with the magnetic oxide.

—S. K.

(*B.*)—RESINS, VARNISHES.

Oxygen Method [Drying Oils for Varnish], The Livache. W. Lippert. Chem. Rev. Fett- u. Harz-Ind. **6**, [4] 65—67.

The author's results are regarded as confirming Weger's opinion of the unreliability of the Livache method as a means of ascertaining the value of drying oils for varnish making. He also finds that the closest approximation to the figures yielded by the plate method is afforded when copper powder is used in place of lead as the carrier of oxygen.

In another set of experiments wherein the oil was distributed over various porous substances, the physical character of these materials had no effect on the absorption of oxygen by the oil, the only acceleration being detected in the case of chemically active bodies like manganese dioxide.—C. S.

Oleo-resin of Dacryodes Hexandra, The Chemical Composition of the. A. More. Proc. Chem. Soc. **15**, [211], 150—151.

The oleo-resin consists of essential oil, a resin, and a white crystalline substance, $C_{25}H_{44}O$, melting at 166°—167°.

The essential oil contains *lævorotatory pinene* and *lævorotatory sylvestrene*, which is the optical isomer of the sylvestrene described by Atterberg.

The crystalline substance is insoluble in water, and only sparingly soluble in strong alcohol. By the action of acetic anhydride, it yields a crystalline mono-acetate, m. p. 200°, and it therefore appears to be an alcohol. It is unaffected by potash and by all ordinary reagents. A tetra-nitro derivative is produced by the action of fuming nitric acid. Chromic acid in acetic acid solution, while oxidising it, appears to cause two molecules to combine; the product is a feeble acid, the molecular weight of which was determined by the cryoscopic method. The substance is probably identical with Personne's ilicic alcohol, m. p. 175°, with which it agrees in composition, and which gives an acetyl derivative melting at 204°—206°.

PATENT.

Varnish, Impts. in or relating to. J. R. Wood, Glasgow. Eng. Pat. 12,211, May 31, 1898.

A quick drying antiseptic varnish or reviver for wax cloth, floors, dados, belting, wood, and such like, consists of from 1—5 grms. of resin, dissolved in 10 c.c. of benzene, naphtha, pentane, or petroleum ether, used either separately or mixed together, with the addition of a little eucalyptus oil or naphthalene.—S. K.

(C.)—INDIA-RUBBER, &c.

Guidroa, The: An India-Rubber Tree of Madagascar. H. Jumelle. Comptes Rend. **128**, [22], 1349.

Most of the india-rubber collected in the Eastern parts of Madagascar, in the districts of Bouéni and Ménabe, appears to be obtained from the guidroa. This tree reaches a height of from 5 to 6 yards, and a mean diameter in the trunk of from 6 to 8 ins. It is a species of Mascarenhasia, of the family apocynaceæ, but different from the 15 or 16 known species of this genus. It, therefore, represents a new species for which the name *M. velutina* is proposed. The india-rubber is collected by making incisions in the bark. The exuding latex immediately coagulates, and is taken off in the form of short strips which are formed into balls. This india-rubber is of good quality, and stronger than when it is prepared by a process of boiling.—C. O. W.

Kickxia Caoutchouc. R. Henriques. Gummi-Zeit. **13**, [26], Chem. Centr. 1899, **1**, [21], 1131. (See also this Journal, 1898, 1158.)

The author has examined the milky juice from the caoutchouc tree called "Ofuntum" by the natives of Malende in the German Cameroons. The dehydrated caoutchouc which had spontaneously coagulated in the milky juice showed an intense brown colour, whilst the lumps containing water possess the pure white colour of the original juice. On extracting the perfectly dry substance with acetone, 3·78 per cent. of caoutchouc resin was obtained. Corresponding to this small content of resin, the Kickxia caoutchouc showed great elasticity without being in the slightest degree sticky. The decanted milk had an odour of ammonia, amounted to 350 c.c., and had a sp. gr. of 0·987. From 25 c.c. was obtained 7·2 grms. of moist containing 4·64 grms. of dried caoutchouc, containing 3·29 per cent. of resin. The Kickxia milk, as regards coagulation, behaved differently from other kinds of caoutchouc milk. It was not coagulated by acid, and salt solution, but only on heating, with or without reagents. On warming in a dish on the water-bath, threads and films of caoutchouc are formed, but only on the surface, where there is contact with the air. The caoutchouc obtained in this manner resembles that coagulated spontaneously in the milk, in colour and other properties.
—A. S.

PATENT.

Caoutchouc, India-Rubber, Gum Elastic and similar Materials; Impts. in the Process of Disvulcanising. A. E. J. V. J. Theilgaard, Copenhagen. Eng. Pat. 8041, April 17, 1899.

The materials are subjected to a treatment with sulphites, which are capable of removing sulphur and oxygen.—S. K.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Micro-Organisms. J. Paessler. Leather Trades Rev. 1899, **32**, [686], and [691], 690.

Bacteria play a most important part in the tanning process in nearly all its branches. Hides and skins, after being removed from the carcase of the animal, do not as a rule pass at once into the hands of the tanner, and since, under the influence of putrefactive bacteria, they would soon putrefy, they must be preserved either by being dried or salted. The efficacy of the drying depends upon the fact that the bacteria are deprived of the moisture which is necessary to their existence, and to be effective, the operation must be thorough. There is danger that even during the process of drying, blood may putrefy and contaminate the hide, by which the grain is injuriously affected; and in order to obviate this evil, all hides and skins, even those which are to be salted, should have the blood and any other putrescent matter, like dung, &c. carefully removed before salting or drying. For this purpose they should be washed in water containing some antiseptic, such as carbolic acid, creolin (formalin is not considered suitable), before being preserved.

In the bran bate the formation of acid is due to the presence of micro-organisms. The efficacy of the dung bate must be ascribed to bacteriological changes, and the phosphoric acid and phosphates which are present have little or no importance in the changes which occur. The bate acts upon the hides mechanically; from the state of being impregnated with lime, hides are transformed into a condition due to incipient putrefaction, which loosens the fibres, so that the impurities, such as lime, &c. can be worked out of them easily by mechanical means.

Starting with this idea, Popp and Baecker found the dung in itself objectionable, and that it could be dispensed with altogether if replaced by another medium adapted to the propagation of the germs, such as a decoction of animal flesh or broth, inoculated with favourable varieties of bacteria. Noerdlinger uses raw potatoes, beetroot, sliced turnips, or refuse of any kind containing starch, dextrin, albumin, sugar. These materials are boiled under steam for half an hour, the decoction rendered alkaline at a temperature of 30° or 40°, and exposed to free access of damp air. As the spores have not been altogether destroyed by boiling, they rapidly increase, and the material becomes covered with a film consisting of bacteria. The decoction is now well stirred, and allowed to stand for eight days; it is then dried at a temperature of from 40°—45°, and reduced to powder. In practice, this powder is mixed with boiling water, and after being cooled down to 40°—45°, can be used as a bateing liquor.

Although ferments and certain species of bacteria play an important part in tanning liquors, in nearly all the changes that take place, the tanning extract itself remains undecomposed, only certain kinds of fungus germs possessing the power of destroying it, and that only when they have exhausted the other ingredients of the liquor. The acids of tan liquors are developed at the expense of the non-tannins, and Andreasch proved that these acids were formed as a consequence of the action of ferments and bacteria, which takes place as follows:—In consequence of the presence of the so-called alcoholic ferments or organisms, sugar is decomposed into alcohol and carbonic acid gas, and the alcohol in the presence of air is converted into acetic acid by the action of the acetic acid bacteria. Lactic acid depends upon the life process of the lactic acid ferments, and is the result of the direct production of sugar. Fresh liquors contain a high percentage of acetic acid and a low percentage of lactic acid, the percentage of the latter increasing, however, in old used liquors. Their effectiveness in raising the hide is by no means of an equal character, lactic acid causing it to swell to a much greater extent than acetic acid. When, therefore, the maximum raising effect is desired, as is the case in the manufacture of sole leather, the formation of lactic acid in the tan liquors should be encouraged.—J. G. P.

Glue and Leather, The Analysis of. W. Fahrion. Chem. Zeit. **23**, [43], 452.

See under XXIII., *page* 712.

Sumac, Detection of Various Adulterants in. Rev. Prod. Chim. **2**, [3], 35.

See under XXIII., *page* 711.

PATENTS.

Rapid Tanning, Process of. Gustav Feith, Skalitz, Bohemia. Eng. Pat. 14,724, July 4, 1898.

This is a rapid tanning process, characterised by a preparatory treatment of the hides after liming with artificially acidified tanning lyes of gradually increasing strength, and subsequently treating the hides in a rotatory vessel under the combined action of acidified tanning extracts or solutions of suitable strength, and of alternately compressed and rarefied air. The acidifying of the liquors may be carried out by the addition of such acids as "tartaric, salicylic, oxalic, or crude carbolic."—J. G. P.

Leather, and Process of Preparing same; A New and Improved Substitute for. W. W. McLaurin, Renfrewshire. Eng. Pat. 12,553, June 4, 1898.

The invention has reference to, and comprises, a new or improved substitute for leather, and process of preparing the same from vellum cloth or equivalent material, by a process of coating and waterproofing same, and in a process for preparing a substitute for leather from vellum cloth, the coating of same with "lactarine" or gelatin or equivalent material in solution, softened or rendered pliable with glycerin, and waterproofing the same by means of formaldehyde, chrome alum, or equivalent material. The materials for the coatings may be mixed with or without the addition of colour.—J. G. P.

Leaching Apparatus, chiefly designed for the Leaching of Tanned Bark, Impts. in. David Young, London. From The Vaughan Machine Co., Massachusetts, U.S.A. Eng. Pat. 7066, April 4, 1899.

This invention relates to an apparatus for leaching, especially designed and adapted for leaching tanned bark, but it is also well adapted for leaching other materials. It comprises a rotatory, normally closed drum to contain the material to be leached, a partition wall or false head within the drum, to form a leaching chamber and a liquor chamber or wall as means to effect communication between said chambers near the circumference of the drum, for the passage of the extract or percolated liquor from the leaching chamber into the liquor chamber, a liquor outlet for the leaching chamber, and a liquor outlet for the liquor chamber. A strainer is interposed within the said chambers, near the circumference of the drum. The apparatus is also supplied with a means of heating the contents, and provided with means within it for lifting a portion of the said material and with special appliances for introducing the liquor and removing the extract.—J. G. P.

XV.—MANURES, Etc.

Ammonium Salts and Chili Saltpetre. P. Wagner. Deutsche Landw. Presse. 1898, 30—31.

With regard to the statements recently made to the effect that the production of ammonium salts in Germany would have been increased long ago if there had been a demand by agriculturists, it is pointed out that the 2,000,000 cwt. produced in Germany have been entirely consumed there, and that ammonium salts of the value of about 12,000*l.* have besides been imported every year. It is the relatively high price of ammonium salts that has prevented their more extended use during the last few years; experiments by the author, Maercker, and Grahl having shown that ammonia-nitrogen ought not to cost more than nitric nitrogen, its manurial value being equal to about 90 per cent. of nitrogen in the form of nitrates.

The conditions which affect the action of the two manures are of various kinds. Ammonium salts have the advantage that, until nitrified, the nitrogen is fixed in the soil. Nitrate of soda is often of use in light soils in increasing the power of retaining water, in supplying nitrogen and phosphoric acid to the plants, and also, to some extent, to replace potash. On the other hand, nitrate of soda induces production of hard crusts on clay soil, rendering the application of lime necessary.

The author urgently advises caution in accepting one-sided results of those interested in ammonia production, and criticises the experiments of Klöpfer (Deutsche Landw. Presse. 1898, 25—26).—N. H. J. M.

XVI.—SUGAR, STARCH, GUM, Etc.

Glucosides, Hydrolysis of, by Mould Fungi. K. Puriewitsch. Ber. d. deutsch. botan. Ges. 1898, **16**, 368—377.

The mould fungi *Aspergillus niger*, *A. glaucus*, and *Penicillium glaucum* effect the cleavage of salicin into glucose and saligenin. Whilst emulsin and the extracts of these fungi decompose amygdalin into glucose, benzaldehyde, and hydrogen cyanide, the action of the living mycelium is quite different; none of these products are formed, and the amygdalin is decomposed by the fungi with formation of ammonia. In general the fungi decompose the glucosides so as to furnish glucose, which is assimilated, and into aromatic derivatives, which may or may not be assimilated. The latter are only assimilated by the fungi when the sugar has been consumed. When the hydrolysis of the glucosides takes place in the presence of media containing carbohydrates, the glucoside is not attacked until a certain amount of the carbohydrate has been consumed.—J. F. B.

Dextrins of Saccharification. P. Petit. Comptes Rend. 1899, **128**, [19], 1176—1178.

The author has further studied the dextrin described by him (this Journal, 1897, **16**, 1028), resulting from the action of 1 per cent. of a very active malt diastase preparation on starch paste at 70° C. This dextrin has the constants $[\alpha]_D = 166 \cdot 6°$ and $R = 18$, and its molecular weight of about 485 corresponds to a formula of $(C_6H_{10}O_5)_3$. When further treated with diastase at 50°—55° C., it is gradually resolved with formation of maltose and a residue of the same unaltered dextrin. A baryta compound containing 21·7 per cent. of barium has been prepared, corresponding to $(C_6H_{10}O_5)_2C_6H_8BaO_5$ which contains 22·06 per cent. Ba. The dextrin is also hydrolysed by the fungi *Penicillium glaucum* and *Aspergillus niger* with increasing cupric reduction to an extent which indicates the production of glucose as well as maltose. If ordinary pressed yeast be allowed to remain in contact with a 3 per cent. solution of salt in presence of toluene for 36 hours, an extract is obtained which also hydrolyses solutions of this dextrin, the extent of the hydrolysis depending on the quantity of yeast and the time of contact. This hydrolytic effect of a simple extract of yeast on a solution of dextrin has a bearing on the phenomenon of the secondary fermentation of beer.—J. F. B.

Beetroots, Direct Analysis of, by Cold Aqueous Digestion. J. Zamaron. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 885—887.

The author criticises the direct determination of sugar in the beetroot by cold aqueous digestion as giving rise to errors from sensible desiccation of the pulp through the mechanical working of the apparatus, and the formation of a troublesome froth, scarcely dissipated by ether, which renders an exact determination of the volume of juice extremely difficult. On 150 analyses made in duplicate by this method and by the hot method, differences were found, in both directions, of 0·2 to 1 per cent. variation from the truth. He advises an alteration in the interior mechanism so as to enable the pulp to be made in less time, and greater homogeneity to be obtained. Meantime he is in favour of the hot water method, finding that digestion for 20 minutes at 95° C. of the subdivided pulp suffices for a total extraction of the sugar.—L. J. de W.

Beetroot Seeds, New Germinator for. E. Lallemant. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 879—880.

It has hitherto been found difficult to regulate the supply of water necessary to keep the sheet of paper, on which the seeds are germinated, moist to the requisite degree. The author proposes to remedy this defect in Schribaux's germinator by placing the paper on a metal plate round the circumference of which there is a tress of cotton drawing up water by capillarity.—L. J. de W.

Sugar Juices, Defecation of, by the Wackernie Process. Barbet. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 888—891.

As it is generally agreed that when carbonation is carried beyond a certain degree, a partial re-solution of the impurities precipitated from the juice by lime, occurs, it is clearly of advantage to separate the calcium precipitate before carbonating and allow the carbonic acid to act only on clarified juice. There is difficulty in realising this procedure practically, particularly if it is desired to effect the separation in the cold, or at least, without appreciable heating of the juice. The Wackernie process consists in treating the raw juice as it leaves the diffusers with a very small quantity of zinc sulphate, which precipitates vegetable albumoses and other viscous bodies which impede filtration. Next, a little barium hydrate is added to precipitate the sulphates and the zinc. Finally, milk of lime is added in quantity just sufficient to produce complete defecation in the cold. Usually 1·2 litres of milk of lime at 20°—22° B. are required.

In order to facilitate filtration, Wackernie adds the scums from the subsequent carbonating, which in this process are absolutely white. Under these conditions the precipitate subsides rapidly and the liquid filters well in the filter presses. The juice then passes through heaters, and is limed more strongly for carbonating. During carbonating no more froth is formed than in the usual second carbonating of the ordinary process. Carbonating once would suffice, but as works-are fitted up for double carbonating, the juice is made to follow the usual course in this respect. The rest of the paper gives figures of actual work by this process, an increase in purity resulting from the increased purification.—L. J. de W.

Sugar Industry, Short Communications from the Prague Research Station for. K. Andrlik. Zeits. Zuckerind. in Böhmen, 1899, **23**, [9], 551—559.

Solubility of Iron Oxide, Alumina, and Silica, Derived from Impure Lime, in Sugar Solutions.—The author treated 10 per cent. cane sugar solutions with 2·5 per cent. of ordinary quicklime at 75° C., and saturated them at the same temperature with carbon dioxide. During the saturation, samples were taken at various degrees of alkalinity, and the above impurities were determined in the ash of the filtered juice. As the alkalinity decreased, the quantity of dissolved iron oxide and alumina diminished; the quantity of dissolved silica, which was only small, remained about the same. When the juice was allowed to remain in contact with the lime at the ordinary temperature for 24 hours, more iron oxide and alumina were dissolved than with short contact with hot solutions, and more of these oxides remained in solution on subsequent saturation.

Solubility of the Calcium Silicate present in the Lime in Sugar Solutions.—When the limestone is not very pure, highly basic calcium and calcium aluminium silicates may occur in the quicklime. These silicates are separated principally in the mud of the first saturation, and on treatment of this mud with a sugar solution, for the purpose of estimating the free lime present, not only is the free caustic lime extracted, but also part of that in combination as silicate, and the estimation by this method is rendered false. The quantity of lime extracted from a mud containing silicates increases with the quantity of sugar solution used for the extraction; water alone is also capable of decomposing these highly basic silicates.

Furfural in Beets and Molasses.—In estimating the furfural from beet molasses, the author noticed that the phloroglucide obtained differed in appearance and colour from the ordinary phloroglucide, owing to the presence of some foreign substance. He concentrated the furfural distillates by repeated salting out and distillation, and fractionated the final ethereal extract. He obtained evidence of the presence of a small quantity of a higher boiling body, which he believes to be methylfurfural, indicating the presence of minute quantities of methylpentosans in beet products.

Analyses of Old Syrups.—The author has analysed some samples of syrups from various stages of the refining process, which were stated to be over 30 years old. He found that the original saccharose, amounting to 41—58 per cent., had undergone inversion and now ranged from 0 to 5·9 per cent.; some of the syrups had deposited crystals, which were identified as *d*-glucose.

Analysis of some Deposits in Sugar Factories.—Analyses are given of some deposits from the tubes of the evaporators; these consist mostly of silicates derived from the impure lime, one, however, resulting from the evaporation of osmose waters, contained 45 per cent. of fatty matter, about half of which was in combination as a lime soap. The analyses of the steam boiler deposits indicate in one case, corrosion of the iron by leakage of juice into the feed water and, in another, passage of lubricating oil into the boiler with the condensed steam. An analysis of mud from a syrup filter, showing a high percentage of silica and alumina, indicates the effect of the juice on impurities in the limestone.
—J. F. B.

Sugar Juices, Electro-hydrosulphite Treatment of. E. Lallemant. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 881—883. (This Journal, 1898, 57.)

This process consists in generating the hydrosulphurous (hyposulphurous) acid in the sugar solution with simultaneous electrolysis.

A Gramme dynamo supplies the current to electrodes placed in a rectangular tank of two hectolitres capacity, the inside of the tank being enamelled. At the bottom is a perforated leaden pipe to pass in sulphurous acid. The electrodes are 4 cm. apart, with 6 square metres available surface, the average current being 0·15 ampère per decimetre. The following series of trials were made:—(1) With zinc electrodes; raw diffusion juice was sulphited to from 0·5 to 1 grm. of SO_2 per litre, and then electrolysed until neutral and finally doubly carbonated. This method was abandoned as the process would take too long. The same juice was next sulphited and electrolysed simultaneously so as to finish in half-an-hour; then doubly carbonated. (2) The last experiment was repeated, using lead electrodes. (3) The syrups, previously cooled to 40° C., were sulphited to 1·5 grms. and electrolysed simultaneously using lead electrodes. The direction of the current was reversed after each operation. In each case a light and abundant froth of albumin was formed. The treated juice took on a milky tint and quickly formed a precipitate on being heated to 60° C., which was easily filtered; the juice was only slightly coloured, but with a faint olive tint. On treating this juice by double carbonation, although only half the usual lime was used, it was scarcely coloured, and was of brilliant appearance. The quotient of purity was increased by four units, and the saline quotient by five units over that by calco-carbonic purification alone.—L. J. de W.

Sugar Beet Investigations in 1898. New York Agric. Expt. Station Bulletin, 1898, [155], 347.

See under XXIV., *page* 716.

Saccharometers Officially Tested. H. Classen. Zeits. angew. Chem. 1899, [21], 496.

See under XXIII., *page* 708.

PATENTS.

Sugar, Impts. in the Manufacture of. E. Beanes, Kent. Eng. Pat. 11,511, May 20, 1898.

The inventor claims the treatment of the defecated juice whilst subjected to heat with ozone or ozonised air, and when the juice has reached a density of 30°—32° B., it is filtered or skimmed, and the treatment with ozone or ozonised air is then continued in the boiling syrup until the sugar point is reached.—J. F. B.

Soluble Starch, Improved Process for Producing. F. Virneisel, Berlin. Eng. Pat. 12020, May 26, 1898.

The process claimed consists in the conversion of ordinary starch or substances containing starch into soluble starch in the wet way. The starch is digested with water containing 1—2 per cent. of mineral or organic acid (preferably sulphuric) at a temperature of from 50°—55° C., until the conversion is complete. The conversion is said to take from 12 to 15 hours, and loss of starch in the form of dextrin or sugar is avoided.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Pectins. E. Bourquelot. Comptes Rend. **128**, [20], 1241—1244.

The author and his colleagues have continued the researches on pectins begun by himself and M. Hérissey last year (this Journal, 1898, 859 and 866). Besides the pectin from gentian root, there described, they have extracted pectins from quinces, from the petals of the Provence rose, from gooseberries, and from *Cynorrhodon*. All these were extracted without the use of acid or alkali; the material, after extraction with alcohol, was treated with water under pressure at 108°—110° C., the aqueous solution precipitated with alcohol, and the alcohol precipitate purified by known methods. They all furnished viscous solutions in water, which were coagulated by lime or baryta water, gave pectic acid with potash, and were coagulated by pectase. They are all dextrorotatory, the angle varying from 82°·3 in the case of the gentian extract to 196° in that of the gooseberry extract. Hydrolysed by weak sulphuric acid, they gave arabinose, which was in each case separated in the crystalline state (in the case of the gentian pectose, doubtful crystals of galactose were observed), and all gave mucic acid when treated with nitric acid.

Germinated barley contains a ferment which hydrolyses all these pectins, a change which neither saliva nor the enzyme from *Aspergillus niger* is capable of effecting; the authors call it, provisionally, *pectinase*. If an infusion of malt be left in contact with any of these pectins, the substance soon becomes incoagulable by pectase, and then contains a reducing sugar. If the pectin has been in the first place coagulated by pectase, the addition of pectinase will cause the gradual disappearance of the coagulum, with formation of the reducing sugar. If both pectase and pectinase be added at once to the pectin, coagulation takes place only if the pectase be in excessive proportion, and the coagulum is then slowly liquefied by the pectinase.—J. T. D.

Malt, On the occurrence of a Peptonising Enzyme in; and researches on the Separation of the Nitrogenous Constituents of Malt, Wort, and Beer. B. de V. Laszczynski. Zeits. für d. ges Brauw. **22**, [6], 71—73; [7], 83—86; [10], 123—129.

As regards the first part of the subject the author concludes, from his results, that malt does not contain any peptonising enzyme and consequently there are no peptones present in malt, wort, or beer. Furthermore that the solubility of the nitrogenous matter in malt depends on the conditions under which the extraction is effected.

The results in the second part of the investigation show that the coagulable albuminoids require pressure (1 hour's exposure at 1½ atmos.) for their complete separation, but can be precipitated in their entirety by phosphotungstic acid and copper hydroxide.

Such of the nitrogenous compounds—the albumoses—as are separable by the aid of zinc sulphate can be (practically) quantitatively thrown down by phosphotungstic acid, but only partly by hydroxide. The weight of precipitate produced by this latter reagent indicates that amides are thrown down by it at the same time, as also appears to be the case with phosphotungstic acid, this last named completely precipitating the xanthin bases as well.

Sodium bisulphite and copper sulphate throw down the xanthin bases; but all the coagulable albuminoids and albumoses must be removed beforehand, since otherwise they would be precipitated at the same time.—C. S.

Malt, Is a Peptonising Enzyme present in? W. Loé. Zeits. für d. ges. Brauw. **22**, [16], 212—214.

Referring to the labours of Laszczynski (see preceding abstract) the author states that the addition of malt extract to crushed barley does not bring into solution from the latter any larger quantity of albumin than can be obtained therefrom by simple digestion without such addition, and he therefore regards as confirmed the opinion formed by Laszczynski that no peptonising enzyme is present in malt. The soluble albuminoids in malt are formed during germination, and it seems probable that the amount passing into solution depends on the method and duration of the extraction.—C. S.

Malt, Valuation of. A. Reichard. Zeits. für d. ges. Brauw. **22**, [8], 95—97; [9], 110—113.

With regard to the floating test, the examination of 56 samples showed that the percentage of "sinkers" varies inversely as the quality of the malt—the average for medium malt being about 20 per cent.—as does also the percentage of prostrate corns in the sinkers. Neither this test, nor the test of friability by biting the corns, is, however, decisive when employed alone; though when the two are taken in conjunction with the length of the acrospire, they give valuable indications as to quality. To this end the percentage of sinkers is ascertained, and the corns sorted into six classes according to the length of the blade. The floating corns are also sorted in the same classification, and the whole subjected to the biting test, the results of which are divided into five classes: friable and mealy, gritty or tough, horny, flinty, and unduly soft.

Corns of the last-named class, if present in quantity, produce an unfavourable effect on the beer. One sample of malt which yielded beer of unusually high attenuation, devoid of "head," and tasting flat, was found to contain 10 per cent. of over-soft and 12 per cent. of over-hard corns, and the growth of the acrospire was irregular, the result being a premature degradation of the starch, and hence a lack of unfermentable dextrins. On the other hand, an excess of the low-molecular products—peptones and amides—of the reduction of the albuminoids, afforded a large supply of yeast nutriment at the expense of the head-forming constituents—albumoses. The glutinous character of some of the corns also led to the removal from the beer of too large a proportion of the head-forming and antiseptic hop resins, the result being flatness of flavour, and a predisposition to disease—as found in practice.

The diaphanoscope enables the relative transparency of the corns to be ascertained with ease, but as moisture renders them more translucent than when in the dry state, the apparatus is less suitable for uncured malt, such as has been steeped after kilning, as well as loose-skinned or nearly exhausted corns; in these cases, the biting test is preferable.—C. S.

Yeast Types, Biological Studies on, with particular Regard to their Practical Use. A. Jörgensen. J. Fed. Inst. of Brewing, 1899, **5**, 259—271.

From the study of a series of English yeasts, the author has already shown that there exist more characteristic and recognisable types of high- than of low-fermentation yeast, and further, that these yeasts are two distinct classes widely different one from the other, and for which a common origin can hardly be imagined. According to Hansen, one single species of yeast, that is a growth descended from a single cell, should be able to carry through the whole fermentation; the author has proved that this holds good under varying circumstances in different countries. The question then arose as to whether this principle could be applied to high fermentation, both in England and the Continent, so as to found a general system on it. With Danish high fermentation yeast it was found to be the case, and various continental countries now employ the process. The author then isolated a number of distinct types of English yeast, with the special purpose of ascertaining whether any of them were able, besides producing a normal primary fermentation, to extend their activity over a prolonged period, and thus carry through an active after-fermentation. The theory formerly held that particular species of yeast were required for the after fermentation in English breweries is not tenable, for some of the types isolated by the author went on working in the beer at different temperatures, and the amount of alcohol increased continually, whilst others had soon finished their work. These latter varieties resembled the Danish high-fermentation yeasts, which should stop fermenting in one to three days.

Notwithstanding these partial results, it was asserted that one species did not suffice for fermentations conducted under English conditions, at least two being required. If, in the future, the conditions are ascertained in which two species of yeast are able to live together in a brewery wort, continually in the same proportion, and in such a way that the whole mass of yeast keeps its character unaltered, which is the first requisite to ensure safety in brewery operations, such a discovery will be of great interest; as yet, however, nothing certain is known. Nevertheless, the author states that "as a matter of fact it has been put beyond a doubt that one species" alone is able to perform the full service.

It is strongly insisted that a proper choice should be made among the many species of yeast. The various properties of a collection of nine English yeasts are described at some length, including their general appearance, film formation, and formation of spores. With regard to the time taken with the different species to form spores on moist gypsum blocks at the temperatures used (9°—10°, 11°—12°, 13°—14°, 15°, 25°, 26°—27°. 30° C.), it is interesting to note that it is possible to distinguish all the species from one another; no two species behaving alike at these temperatures. The comparative amounts of alcohol produced by the nine species during primary and secondary fermentation are given, and it appears that greater differences exist between the species with regard to the amount of alcohol formed in the secondary fermentation.—J. L. B.

Beer and Electricity. A. C. Chapman. J. Fed. Inst. of Brewing, 1899, **5**, 278—292.

From the experimental results obtained by the action of the electric current on beer, the author arrives at the following conclusions:—1. That electricity *quâ* electricity has no effect upon the stability of beer. (2.) That the products of electrolysis (assuming the electric current to have been capable of producing such products in appreciable quantity) would exert but little influence; moreover, this influence would tend to retard the changes due to bacterial activity. 3. That the quantity of ozone present in the atmosphere during thunderstorms would be insufficient to produce any marked change. Any effect produced, as in the case of the products of electrolysis, would be in the direction of increased stability. 4. That beer, like many other articles of food (meat, milk, &c.), is more liable to undergo change during warm thundery weather than at other times is well known, but electricity is not to be considered as either the direct or indirect cause. The explanation is that those meteorological conditions which result in thunderstorms happen to be also those which most favour bacterial infection and reproduction. It is probable also that the barometric changes which precede a thunderstorm might result in the withdrawal of air very rich in micro-organisms from the upper layers of the "living" soil, thus increasing the already considerable chances of bacterial infection —J. L. B.

Fermentation from the Distiller's Point of View, with Notes on other parts of the Distiller's Process. C. G. Matthews. J. Fed. Inst. of Brewing, 1899, **5**, 225—250.

The author describes the requisites of a fermentable solution such as is used in the manufacture of alcohol, also the preparation of the wort and its fermentation as carried out in this country. The following is a general outline of a spirit and pressed yeast manufacturing process: (*a*) The preparation of a preliminary mash or wort ("Hefegut") for the mother-yeast; it should be a rich all-malt wort. (*b*) The artificial souring of the "Hefegut" at a temperature of 122°—125° F. till it shows a fair percentage of lactic acid. (*c*) Raising the temperature of the "Vormaisch" or "Hefegut" to 155°—160° F., in order to destroy the lactic acid-producing organisms. (*d*) Cooling and pitching of the "Hefegut" with strong yeast reserved from a previous fermentation. (*e*) The yeast in the "Hefegut" being ripe, a quantity is taken off to be used in the next fermentation. (*f*) The remainder in a state of active fermentation is used for pitching the chief mash or the worts derived from it, or the remainder of the yeast obtainable by skimming is so used.

The preparation of the chief mash is described in some detail; it appears that the loss of starch contained in the grist is diminished from 5—10 per cent. to 1·75—2·75 per cent. by the use of high pressure plant. The author lays stress on the importance in the continental distillery process of protecting the wort from bacteria by having free acid present. Although mineral acids have been experimented with, it is generally agreed that lactic acid possesses advantages over other acids.

The fermentation of distillers' worts of fairly high gravity may be divided into three chief periods:—(1.) Pre-fermentation. Assimilative and recuperative period of the yeast. (2.) Chief fermentation. Fermentation of the free sugars. (3.) After fermentation. Period of fermentation of some of the combined maltose, and of maltose derived from degradable dextrins. The preparation of "lufthefe," and a description of the various kinds of fermentation is also given.—J. L. B.

Fermenting Vats, The Cooling of, under Motion. H. Lange. Zeits. Spiritusind, 1899, **22**, [25], 224.

The introduction of these appliances was first rendered imperative when, on account of fiscal reasons, German distillers and brewers had to ferment the thick mashes obtained by the decoction method. Numerous forms of these devices are made, but experience has shown that the efficiency of cooling and removal of carbon dioxide are greatest when the convolutions of the worms lie in one plane and when the motion is as energetic as possible. In most systems the cooling worms or pipes themselves are agitated, though in some, separate agitators are provided and the cooling tubes are fixed. The choice of a particular system should be guided largely by the ease with which the pipes can be cleansed from the impurities deposited from the water, since any accumulation of these causes a vast decrease of efficiency. The requisite power is extremely small, and the author calculates that the installation cost for 10 vats should not exceed 2,000 marks.

By the use of these devices, the vats can be filled much higher than otherwise without fear of frothing over. Under

German conditions, it is calculated that a vat of 3,000 litres capacity can be made to hold 150 litres of mash more than if mechanical agitation were not adopted, an increase which is worth 1,800 marks per campaign. Agitation throughout the whole of the fermentation period has been found to increase the yield by 0·4—0·6 per cent. Moreover, regulation of the temperature so that it never exceeds 29° C. considerably prevents loss of alcohol by evaporation.

—J. F. B.

Beetroot Juice, Process for Fermenting Rich. E. Sorel. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 907—909.

The difficulty of fermenting beetroot juice at higher density than 3° or 4° is attributed by the author to the antiseptic action of iron and copper salts dissolved from the vessels. Juices prepared in the cold, containing 4 or 5 mgrms. of iron or copper, cannot be fermented. The first condition necessary is, therefore, to stop the use of acid during diffusion; but as the exhaustion of the pulp is thereby rendered slower, the first diffuser is worked at a higher temperature. The juice is then heated, with a slight acidification, as it leaves the first diffuser, so as to produce gelatinous bodies capable of fixing metallic oxides. Energetic aëration, obtained by passing the hot juice down a column provided with a ventilator, restores the fermentability and cools the juice considerably on its passage to the fermentation vat, and has the further advantage of removing, by volatilisation, the essential flavour of the beetroot, so that the spirit obtained does not betray its origin.—L. J. de W.

Mucedinæ in the Distillery, The Use of. A. Boidin. Congrès de l'Assoc. Chim. Sucr. et Dist. Paris, 1899; through Rev. de Chim. Industrielle, 1899, **10**, [113], 125—129.

The author corrects and brings up to date the descriptions which have been published of his process, as carried out at the Seclin distillery (see this Journal, 1899, 157). The historical summary includes Calmette's discovery of *Amylomyces Rouxii* and the improvements introduced by him in the Chinese methods of fermentation. The author gives an account of his early experiments, leading to the conclusion that there is no loss of carbohydrates by respiration of the fungi if these be wholly immersed and if a current of air be supplied. He confirmed Gayan and Dubourg's results in 1887, that mucedinae are capable of yielding more alcohol from starch than the theoretical amount calculated by Pasteur's equation. The fungi, however, are deficient in starch liquefying powers; the grains in the distillery are therefore treated with 1—2 per cent. of malt before sterilisation, in order to liquefy the gelatinised starch; the subsequent operations have already been described in this Journal, *loc. cit.* At Seclin, the vinasse is filtered after distillation, and the cakes dried *in vacuo* and extracted with petroleum ether. The *Amylomyces Rouxii*, which is incapable of withstanding more than 4·5 per cent. of alcohol, and which necessitated the employment of dilute mashes, has been discarded, and the distillery has been working for a year with another fungus, obtained from Japan, and named by the author *Mucor β*. With this fungus, mashes of 18 kilos. of grains per hectolitre are worked, and satisfactory results have even been obtained up to 25 kilos. Still more recently another mould, *Mucor γ*, has been isolated from a sample of Tonkin rice, giving attenuations of 0·1°—0·2° Bg. higher than *Mucor β*, so that when the experiments have been completed, still better results are looked for. *Mucor racemosus* is also applicable.

The acidity produced by *Mucor γ* is only 0·7 grms. per litre in 18 kilo. mashes, being one-half of that produced by *A. Rouxii* in 12 kilo. mashes. The author compares his process with the older methods, laying stress on the saving of losses of carbohydrates in the processes of malting, lactic acidification, and saccharification. The traces of starch escaping liquefaction by the malt in the new process all disappears by the end of the fermentation. The yield of 97·5 per cent. of the theoretical is stated to be the maximum obtainable, owing to the mass action of diastatic enzymes and the traces of unfermented carbohydrates. The filtration after distillation is very much easier than with the old processes; and the cake is sold as poudrette containing 6·5—5 per cent. of nitrogen. It is intended to evaporate the liquors, now given to the fields, in a triple effect, which, considering the absence of gummy matter, should be effected economically.—J. F. B.

Brandy (Spanish), The Composition of. C. A. Cameron and W. R. Smith. The J. of State Med. 1899, **7**, [6], 317—324.

Reference is made to the well-known fact, that by far the greater portion of the spirit sold as brandy is not produced from wine, but consists, wholly or partly, of grain or potato spirit, artificially flavoured by the addition of ethers, &c. Statistics are quoted to show that the strongest suspicion attaches even to the supposed genuine "Cognacs" shipped from the Charente inferieure district of France. In 1876, when the vines were first attacked by phylloxera, the quantities of wine grown, of brandy produced therefrom, and of brandy shipped, were in accord; but at the present day this is very far from being the case, as shown by the following figures:—

Year.	Hectolitres of Wine Produced.	Hectolitres of Brandy Produced.	Hectolitres of Brandy Shipped to other Countries and Consumed in France.
1875	12,662,944	2,355,682	1,883.763
1898	845,592	40,267	2,349,980

The facts are significant. It is possible, of course, that the deficiency in home production is made good by importations of genuine brandy from other sources. In any case, the question arises: Can the wines of countries other than France yield good brandy? In this connection the authors have examined a number of Spanish brandies, distilled at Jerez, in Southern Spain, and find them to be fully equal to, and comparable with, the best French Cognac, as regards odour, flavour, and chemical composition. The mean results of the analyses are subjoined:—Specific gravity at 60° F., 0·9391; absolute alcohol by weight, 40·35 per cent., corresponding to 83·6 per cent. of proof spirit by volume.

Amount of By-Products, in Grams, Associated with 1 Hectolitre of Absolute Alcohol in the Brandy.

Volatile acids calculated to acetic acid	57·41
Fixed acids calculated to tartaric acid	80·68
Total free acids calculated to acetic acid ...	122·01
Ethers calculated to acetic ether...........	107·14
Higher alcohols calculated to iso-butyl alcohol	137·91
Aldehyde.....................................	163·45
Furfurol.....................................	1·41

—H. T. P.

Acetifying Bacteria. D. P. Hoyer. Dissertation, Leiden, 1898, through Centralbl. für Bakteriol. [II. Abth.], 1898, **4**, [23], 867.

The author adopts Beijerinck's method of classification under four typical species (see this Journal, 1898, 940). The two industrial types of vinegar bacteria are *B. aceti Pasteur* of the "quick vinegar process" and *B. rancens* of beer vinegar. Morphological characteristics are of little use for the recognition of the species, and the following physiological tests are usually applied:—The behaviour in Pasteur's mineral solution, in which only *B. aceti* forms a film, and the behaviour in presence of cane sugar; only *B. aceti* and *B. xylinum* form slimy deposits and cause inversion when grown in solutions of cane sugar.

Two of the typical species are found in beer, *B. rancens* and *B. Pasteurianum*, the latter occurring much less frequently than the former. The author enumerates the names of the different bacteria which he regards as variations of these two beer vinegar types, together with some new varieties which he describes in his paper. *B. xylinum* is found in breweries, and although it possesses certain properties in common with *B. aceti*, its mode of growth is quite unmistakable; besides, *B. xylinum* is the only species which oxidises sorbitol to sorbose and mannitol to levulose. The author has determined the times and degrees of the resistance of the bacteria to the action of heat in the dry and wet state and to the presence of alcohol, acetic acid, and salts in the culture liquids. The nutrition of the acetifying bacteria may be "genetic," in which case the organisms multiply without exercising their specific acetifying functions, or "zymotic" when they merely oxidise but do not multiply; either process may take place separately or both simultaneously according to conditions. Glucose is both a genetic and a zymotic nutrient, whilst alcohol is only zymotic. The presence of free oxygen is necessary for the growth and reproduction of the bacteria, and carbon dioxide is given off. During the acetification process this gas is derived from the zymotic nutrient and afterwards from the acetic acid produced, and not directly from the alcohol. Besides the four organic elements, only potassium, magnesium, and phosphorus are essential for the genetic nutrition.

The nitrogen is derivable from peptone, asparagine, nitrates, and ammonium salts, in different degrees according to the source of the carbon and the species of bacteria. Favourable carbon nutrition (glucose) enables the bacteria to assimilate nitrogen from unfavourable sources (nitrates). With favourable nitrogenous nutrition all the species can utilise glucose as a source of carbon and some of the species can derive their carbon from cane-sugar, acetic, lactic, succinic, citric, malic, and gluconic acids and their salts. Alcohol cannot act as a source of carbon, and tartaric acid is not taken up by the bacteria. Malic, citric, and hydrochloric acids cause considerable modifications in the forms of the beer-vinegar bacteria. The bacteria can be dried without losing their vitality; living bacteria are stained by phloxin. Potassium salts act more favourably than the corresponding sodium salts in equimolecular concentrations. The bacteria retain their vitality when the air supply is cut off, and they then reduce Indigo, Methylene Blue, and litmus.

The average yield of acetic acid from alcohol is about 77 per cent. with the film-forming beer-vinegar bacteria, and 85 per cent. with those which grow underneath the surface.

The quantities of alcohol or acetic acid which put a limit to the growth of the colonies have no effect on their acetifying functions. Less than 4 per cent. of alcohol does not affect the growth; 9 per cent. of alcohol stops it. Acetic acid in any concentration is unfavourable to the growth of the colonies. Substances which inhibit the acetifying process also inhibit the growth, but the converse does not hold. The acetifying bacteria are very resistant to changes of osmotic pressure.—J. F. B.

Lactic Fermentation. H. Pottevin. Ann. de l'Inst. Pasteur, 1898, 49.

The author draws the following conclusions:—The lactic ferment can produce under proper conditions active lactic acid corresponding to 80 per cent. of the sugar decomposed. The nature of the acid is not directly dependent on the chemical function nor on the constitution of the carbohydrate from which it is produced. All the factors which have a retarding effect on the culture, such as deficiency of nitrogenous nutrition, elevated temperature, addition of antiseptics, resistance of the carbohydrate used, were found to be accompanied by the production of the dextro acid; possibly other conditions might be arrived at which would favour the formation of the lævo acid.—J. F. B.

Commercial Lactic Acid in Potato Distilleries, The Use of. H. Lange. Zeits. für Spiritusind, 1899, **22**, [21], [22], 186—189 and 196. (Compare this Journal, 1898, 1065.)

The author has carried out a series of strictly comparable experimental fermentations on the large scale, acidifying the yeast mash with commercial lactic acid and with acid produced in the usual manner by fermentation, in parallel daily mashings. In all cases the fermentation, attenuation and yield of alcohol were normal, and there was no result indicating any advantage or disadvantage with the commercial acid. Practically the only inducement for the employment of this acid is its simplicity and certainty. The correct acidification of the mash by natural lactic fermentation is a very delicate operation, necessitating perfect plant and expert supervision for its control; the commercial acid on the other hand can be added in the desired proportions without any trouble. No time is really saved with the commercial acid, and the only saving is the small quantity of steam required to keep up the favourable lactic fermentation temperature. The cost of the commercial acid is high, ranging from 218—254 marks per campaign, according to proportions required, whilst the same acidity can be produced by fermentation from starch at a cost of 77—140 marks per campaign. Still, the results of the author have been obtained at a distillery with a first-class equipment, and it is quite possible that, where inferiorities of plant or material cause difficulties and uncertainties in the natural acidification, a saving may be effected by the uniformity obtainable with the commercial acid.—J. F. B.

Methyl Alcohol in Spirits, Method for Detecting. A. Trillat. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 870—871. (See this Journal, 1898, 879.)

See under XXIII., *page* 711.

Methyl Alcohol in Natural or Compound Liqueurs. Formation of Acetals in Liqueurs. A. Trillat. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 871—877.

See under XXIII., *page* 711.

Copper, Method for the Rapid Determination of, for Use in the Vineyard. M. Zecchini. Staz-sperim. agrar. ital. **32**, 117. Chem. Centr. 1899, **1**, [19], 1085.

See under XXIII., *page* 710.

PATENTS.

Brewing and the Production of Alcoholic Beverages, Impts. in or relating to. F. Faulkner, J. E. J. Johnson and the Non-Deposit Beer Company, Birmingham. Eng. Pat. 14,305, June 28, 1898.

The inventors claim the production of a wort of a highly dextrinous or gummy and gas-retaining quality by mashing malt with liquor of a temperature of 177°—180° F. so as to obtain a mixture temperature of about 160° F., and adding thereto a highly diastatic malt extract. Also preparation of alcoholic beverages of a sparkling and foaming character, and free from sediment by fermenting the above wort, racking the beer into casks with the addition of hops, storing for a suitable time at ordinary temperatures and afterwards at a low temperature, agitating it from time to time, and finally filtering it into casks or other receptacles.
—J. F. B.

Sterilising Liquids [Ferments, &c.], Impts. in; and in Apparatus therefor. L. Nathan, Zürich, Switzerland. Eng. Pat. 16,355, July 27, 1898.

The bottles containing the liquid to be sterilised are placed in a vessel fitted with a simple rocking or shaking device, steam or hot water is admitted to the outer vessel, and the shaking is continued during the heating, for the purpose of mixing the liquid and air in the bottles. By this operation a lower temperature is needed for complete sterilisation.
—W. P. S.

Malt Wines, Impts. in and connected with the Fermentation and Manufacture of. A. Munsche, Altona, Germany. Eng. Pat. 16,896, Aug. 4, 1898.

The present specification relates to the process, the details of which were abstracted in this Journal, 1899, 387. The inventor claims the use of a lactic solution of sugar or a lactic acid malt extract with the object of producing an aroma and higher alcoholic contents, adding these to malt wort which has not undergone alcoholic fermentation, preparing the stock with mature "sour wine barm" and adding similar barm thereto from time to time during fermentation, adding "fruit ether barm" during fermentation, and finally "dextrin barm" after removal of

the contained barm; storing the product at a high temperature not exceeding 30° C. Partially fermented and sterilised wort may be treated in a similar manner. The successive additions of fresh quantities of sour wine barm during fermentation, render it possible to obtain higher proportions of alcohol than would otherwise be produced.
—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Proteids, Solubility of, in Glycerin. H. Ritthausen. J. prakt. Chem. 1899, **59**, [8—10], 479—480.

In the year 1882, the author remarked on the solubility of the crystalline proteids of hemp and castor oil seeds in glycerin. This observation is of interest in view of the extraction of peptic enzymes obtained by von Wittich with this solvent. Osborne has confirmed the observation of the author as to the solubility of the crystalline globulins of hemp, castor oil seed, almonds, and other plants in glycerin, whilst the globulins from maize, wheat, rye, oats, &c., were found to be insoluble. As regards the globulins of hemp and castor oil seed, when they are prepared by precipitation with water or by crystallisation from hydrochloric acid solutions, they are soluble, but when obtained by dialysis, they are insoluble in glycerin.—J. F. B.

Wheat Aleurone or Gluten, The Proteids of. H. Ritthausen. J. Prakt. Chem. 1899, **59**, [8—10], 474—478.

In his earlier investigations, the author considered that he had proved the existence of four components of wheat-gluten, namely, gliadin or vegetable glue, gluten-fibrin, mucedin, all soluble in alcohol and gluten-casein, insoluble in spirits of wine. Later, however, Osborne and Voorhees, Fleurent, and Kjeldahl all agreed that the portion soluble in alcohol was homogeneous, consisting of gliadin. The author, although his analyses of the separate portions indicated the existence of different bodies, defers to the weight of authority, and supposes that some of his preparations must have been contaminated with fat. K. Morishima (Chem. Centr. 1898, **2**, 1162) has recently concluded that only one substance which he named artolin, is present in wheat gluten. This was separated by acidifying the gluten solution with 1 per cent. of hydrochloric acid and purifying the precipitate so obtained by means of alcohol. The author remarks that in this class of work an excess of acid must always be avoided because some of these proteids are completely soluble in the presence of small quantities of dilute acid and are not precipitable by acid unless large quantities of salts be present. He therefore thinks that Morishima's conclusions are to be regarded as doubtful, and that probably the more soluble constituents of gluten as gliadin or gluten-fibrin remained behind in the solutions, and escaped notice, artolin being probably identical with the gluten-casein already described.—J. F. B.

Fat in Milk, Source of Error in Modifications of the Leffmann-Beam Method for the Estimation of. H. Droop Richmond and F. R. O'Shaughnessy. Analyst, 1899, **24**, [279], 146.

See under XXIII., *page* 713.

PATENTS.

Seminal Foods, Impts. in the Preparation of. H. E. Wright, Wickwar, Glos. Eng. Pat. 15,127, July 9, 1898.

To increase the amount of mineral matter in cereal and leguminous seed, &c., the patentee claims "the right of using solutions of iron, solutions of calcium salts, of phosphates generally or of phosphoric acid in the steeping or treatment of cereal or leguminous seeds, whether they are to be germinated after the manner of malt or not, or of the seed-yielding plants of which the green portion is edible." Also "the right of adding inorganic salts to any product of the above-named seeds in order to raise the ash of the mixed product up to a definite standard."—W. P. S.

Diastasic Preparation to be employed in the Manufacture of Bread, Biscuits, and the like, An Improved. B. J. B. Mills, London. From A. Dalmote, Ypres, Belgium. Eng. Pat. 15,196, July 11, 1898.

According to this specification green malt, in which the plumule has been allowed a greater development than usual, is ground in the presence of a small stream of cold water. From the outlet of the grinding machine the milk of malt is run on to screens or sieves. It is used by mixing with yeast and adding to the dough when kneading.

The milk of malt may be preserved by saturating with carbonic acid gas, and storing in hermetically-closing bottles.—W. P. S.

Preservation of Meat, and in Apparatus therefor, Impts. in the. A. Zimmermann, London. From The Chemische Fabrik auf Actien vorm. E. Schering, Berlin. Eng. Pat. 15,654, July 16, 1898.

The meat is preserved by exposing it to gaseous formic aldehyde (prepared from tablets of paraformic aldehyde) in a closed chamber, and then ventilating the chamber with germ-free air. The construction of this chamber is claimed. It consists of a wooden box similar to an ice chest, with a ventilating chimney, closed by a damper. The chest has openings in its sides plugged with cotton wool filters, and is provided, of course, with a door.—W. P. S.

Preserved Egg, Impts. in and relating to the Manufacture of. J. Mecredy, London. Eng. Pat. 7064, April 1, 1899.

The improvements claimed consist in mixing the whites and yolks of eggs *in vacuo*, adding a mixture of sodium chloride and sodium phosphate (about three quarters of an ounce of the anhydrous salts to 100 eggs) and evaporating the mixture *in vacuo* to a syrupy consistency. The syrup may then be kept in closed vessels or dried at about 130° F. until it assumes a solid flaky form.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Hydrological Investigations, Use of Colouring Matters in. F. Jean. Rev. de Chim. Industrielle, 1899, **10**, [113], 121—123.

Since Kopp in 1877 demonstrated the connection between Lake Constance and the river Danube by placing 10 kilos. of fluorescein in the river, colouring matters have been of great assistance in tracing connections, or contaminations of water courses. Fluorescein has succeeded where Aniline Violet has failed, and the present paper is a *résumé* of some work by Trillat on the influence of the nature of the soil and water on various colours. In distilled water, at a dilution of 1 part per 50 millions, the order of intensity was fluorescein, Malachite Green, Methylene Blue, Magenta, Safranine and Congo Red. With water of 40° hardness, most of the colours were discharged, Safranine and Methylene Blue could still be detected and fluorescein after filtration, Congo Red and Eosin were just perceptible. Calcareous and ammoniacal soils decolorised all the dyes with the exception of fluorescein; the colour of Acid Magenta, however, was regenerated on subsequent acidification with acetic acid. Peaty soils absorbed even fluorescein, but Magenta could be detected after acidulation. Argillaceous and sandy soils allowed the colours to pass through, but in an enfeebled state. Trillat made use of a "fluoroscope" consisting of two vertical glass tubes 1·2 metres long, closed at one end with a black cork, the fluorescent water was distinguished by its clear green colour as compared with the darker shade of the natural water. The presence of 1 grm. of fluorescein in 2,000 cubic metres of water could be recognised in this way. Trillat concludes that only fluorescein and Acid Magenta are suitable for hydrological investigations; the fluorescein should be dissolved in alcohol with the addition of 5 per cent. of ammonia. Acid Magenta should be used for drainage waters from humus soils, perhaps in conjunction with fluorescein, the quantity of colouring matter should be adapted to the volume of water, 100—1,000 grms. should suffice.—J. F. B.

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XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

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Sulphur iodide is found to be less irritant and therefore more suitable for internal medicinal use than iodised sulphur. It should, however, be employed in a diluted form, by mixing it with finely powdered sulphur.—J. O. B.

Colloidal Metals: Bismuth and Copper. A. Lottermoser. J. prakt. Chem. 1899, **59**, [8—10], 489—493.

In continuation of his work on colloidal metals (this Journal, 1898, 790), the author has prepared colloidal bismuth in the following manner :—Bismuth nitrate is dissolved in water, acidulated with nitric acid, ammonium citrate solution is added until the precipitate at first formed is redissolved, and the liquid is then made alkaline with ammonia. In the same way a solution of stannous chloride in ammonium citrate is prepared to which ammonia is only added to neutral reaction; three molecular proportions of this solution are added to two of the bismuth solution, and the liquid, which should remain clear at first, becomes brown after some time, and finally a black precipitate separates out. This precipitate consists of colloidal bismuth, and is soluble in water, giving a brown solution. Unlike mercury, bismuth salts are not reduced by stannous chloride in acid solution. Colloidal bismuth is precipitated from its solution by acids and salts, alkali and ammonium salts throwing it down in the soluble form. This colloidal bismuth is a mixture of bismuth and colloidal stannic acid, and repeated re-solution and precipitation fails to entirely remove the contaminating tin. This has been shown by means of the formation of purple of Cassius and colloidal silver reduced by tin salts, both of which have been synthetically prepared by mixing the colloidal metal and colloidal stannic acid. (See Zsigmondy, Annalen, **301**, 261; this Journal, 1898, 962.) The colloidal mercury described *loc. cit.* is also contaminated with tin in the same way. Colloidal copper has been prepared by the author by treating cupric chloride with excess of stannous chloride, using ammoniacal ammonium citrate solutions, and heating. A white cloudiness is first formed which darkens to yellow, red, and finally black. The precipitate consists of colloidal copper contaminated with colloidal stannic acid; it gives a reddish-black solution with water, which absorbs oxygen from the air very readily. The colloidal metals prepared with stannous chloride readily lose their solubility on attempting to obtain them in the dry state.—J. F. B.

Staphisagroïne: A New Alkaloid. F. B. Ahrens. Ber. 1899, **32**, [9], 1581—1584.

In the seeds of *Delphinium staphisagria* a number of alkaloids have been found: delphinine, $C_{22}H_{35}NO_6$; delphinoidine, $C_{42}H_{68}N_2O_7$; delphisine, $C_{27}H_{46}N_2O_4$ (?); staphisagrine, $C_{22}H_{33}NO_5$; whilst in the residue left after the removal of these alkaloids by chloroform, staphisagroïne, $C_{20}H_{24}NO_5$, was found. This forms an amorphous white powder, with a tinge of yellow, melting at 275°—277° C., and almost insoluble in the ordinary solvents. Its picrate is obtained by triturating the alkaloid with a 0·1 per cent. solution of picric acid in absolute alcohol, and then boiling on the water-bath. After drying at 100° C., it melts at 215°—216° with decomposition. The platinum double salt, $(C_{20}H_{24}NO_4.HCl)_2PtCl_4 + 7H_2O$, is completely precipitated on mixing solutions of its components. It forms a light yellow amorphous powder, which does not melt at 275° C.

In an attempt to regenerate the alkaloid from its platinum double salt by treatment with sulphuretted hydrogen, removal of excess on the water-bath and precipitation by ammonia, a brownish powder was obtained melting at 185° C. This is another base, staphisagroïdine, $C_{20}H_{20}NO_2$, which bears the same relationship to staphisagroïne that staphisagrine bears to delphinine. Staphisagroïne does not give the colour reactions of the other *Delphinium* alkaloids.

—A. C. W.

Alkaloids of Anagyris Fœtida. M. Klostermann. Inaug. Diss. Marburg, 1898; Chem. Centr. 1899, **1**, [21], 1130.

By extraction of the seeds of *Anagyris fœtida* with 60 per cent. alcohol containing about 5 per cent. of acetic acid, then distilling off the alcohol, treating the aqueous extract of the residue with lead acetate, and decomposing the precipitate with sulphuretted hydrogen, a crude alkaloidal mixture is obtained consisting of cytisine and anagyrine. The alkaloids are separated by treating the hydrochloric acid solution with mercury chloride, the anagyrine being precipitated in the form of a double chloride, whilst the cytisine remains in solution. Anagyrine could not be obtained in a crystalline form, but cytisine forms white needles from ligroin (petroleum spirit), m. pt. 152°—153° C. From a comparison of the properties of cytisine and of anagyrine, the author concludes that anagyrine is butylcytisine.—A. S.

Cocaine Hydrochloride. B. H. Paul and A. J. Cownley. Pharm. J. 1899, **62**, [1511], 524—525.

The authors controvert the statement of Guenther, that the crystalline precipitate produced by MacLagan's test for the purity of cocaine hydrochloride is due to isomeric ethylbenzoylecgonine and not to cocaine. Operating upon pure synthetic cocaine hydrochloride, they show that the crystalline base obtained by that test melts at 97° C. in Roth's apparatus, and that is the m. pt. of pure cocaine. Guenther states that his isomeride melts at 111° C. The critical point of MacLagan's test, which has been much discussed of late, is the solubility of cocaine in water. As the test was originally given, 1 grain of cocaine hydrochloride was directed to be dissolved in 2 fluid ounces of water, or 0·8925 of alkaloid to 875 of water, or 1:980. The exact solubility of cocaine in water cannot be determined by the ordinary methods, since in the presence of water it gradually undergoes decomposition into benzoylecgonine, especially when an alkali is also present. The only practical method of determining the solubility of the base under the conditions of MacLagan's test is to note the precise point in the ratio of water to base at which the crystalline precipitate ceases to appear. This, operating with the hydrochloride prepared from pure synthetic cocaine melting at 97° C., was found to be about 1:1500 at 15·5° C., and not 1:704 as stated by Guenther. The authors conclude, therefore, that the crystalline precipitate obtained by MacLagan's test is cocaine; that the solubility of that alkaloid in water is not greater than the conditions of the test prescribe. They reiterate that a specimen of cocaine hydrochloride which will not answer this test is not suitable for medicinal use.

—J. O. B.

The Aloïns. E. Léger. Comptes Rend. **128**, [23], 1401—1403. (See also this Journal, 1898, 866.)

Aloes from Natal, after exhaustion with acetone, gave up to boiling methyl alcohol a substance which was deposited on cooling in yellow plates. This, fractionally crystallised from methyl alcohol, yielded two substances, the more soluble "*nataloïn,*" and the less soluble "*homonataloïn,*" the latter in the greater quantity.

Nataloïn crystallises in pale yellow lamellæ, less soluble than barbaloïn in methyl alcohol, almost insoluble in water or ether; it exhibits the phenolic character of barbaloïn, dissolving in caustic but not in carbonated alkalis; it dissolves in ammonia or in pyridine; in hydrochloric or hydrobromic acid it dissolves less easily than barbaloïn, in acetic acid only on long heating. Analysis points to the formula $C_{16}H_{15}O_7$. With acetyl chloride it gives derivatives, but the carbon content of different acetyl derivatives is not sufficiently different to make distinction safe. Benzoyl chloride, with the pyridine solution of the substance, gives a tri-derivative, which, when heated in sealed tubes with excess of the chloride, is converted into a tetra derivative, so that nataloïn contains four hydroxyl groups.

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Colloidal Metals: Bismuth and Copper. A. Lottermoser.
J. prakt. Chem. 1899, **59**, [8—10], 489—493.

In continuation of his work on colloidal metals (this Journal, 1898, 790), the author has prepared colloidal bismuth in the following manner :—Bismuth nitrate is dissolved in water, acidulated with nitric acid, ammonium citrate solution is added until the precipitate at first formed is redissolved, and the liquid is then made alkaline with ammonia. In the same way a solution of stannous chloride in ammonium citrate is prepared to which ammonia is only added to neutral reaction; three molecular proportions of this solution are added to two of the bismuth solution, and the liquid, which should remain clear at first, becomes brown after some time, and finally a black precipitate separates out. This precipitate consists of colloidal bismuth, and is soluble in water, giving a brown solution. Unlike mercury, bismuth salts are not reduced by stannous chloride in acid solution. Colloidal bismuth is precipitated from its solution by acids and salts, alkali and ammonium salts throwing it down in the soluble form. This colloidal bismuth is a mixture of bismuth and colloidal stannic acid, and repeated re-solution and precipitation fails to entirely remove the contaminating tin. This has been shown by means of the formation of purple of Cassius and colloidal silver reduced by tin salts, both of which have been synthetically prepared by mixing the colloidal metal and colloidal stannic acid. (See Zsigmondy, Annalen, **301**, 261; this Journal, 1898, 962.) The colloidal mercury described *loc. cit.* is also contaminated with tin in the same way. Colloidal copper has been prepared by the author by treating cupric chloride with excess of stannous chloride, using ammoniacal ammonium citrate solutions, and heating. A white cloudiness is first formed which darkens to yellow, red, and finally black. The precipitate consists of colloidal copper contaminated with colloidal stannic acid; it gives a reddish-black solution with water, which absorbs oxygen from the air very readily. The colloidal metals prepared with stannous chloride readily lose their solubility on attempting to obtain them in the dry state.—J. F. B.

Staphisagroïne: A New Alkaloid. F. B. Ahrens.
Ber. 1899, **32**, [9], 1581—1584.

In the seeds of *Delphinium staphisagria* a number of alkaloids have been found: delphinine, $C_{22}H_{35}NO_6$; delphinoidine, $C_{42}H_{68}N_2O_7$; delphisine, $C_{27}H_{46}N_2O_4$ (?); staphisagrine, $C_{22}H_{33}NO_5$; whilst in the residue left after the removal of these alkaloids by chloroform, staphisagroïne, $C_{20}H_{24}NO_5$, was found. This forms an amorphous white powder, with a tinge of yellow, melting at 275°—277° C., and almost insoluble in the ordinary solvents. Its picrate is obtained by triturating the alkaloid with a 0·1 per cent. solution of picric acid in absolute alcohol, and then boiling on the water-bath. After drying at 100° C., it melts at 215°—216° with decomposition. The platinum double salt, $(C_{20}H_{24}NO_4.HCl)_2PtCl_4 + 7H_2O$, is completely precipitated on mixing solutions of its components. It forms a light yellow amorphous powder, which does not melt at 275° C.

In an attempt to regenerate the alkaloid from its platinum double salt by treatment with sulphuretted hydrogen, removal of excess on the water-bath and precipitation by ammonia, a brownish powder was obtained melting at 185° C. This is another base, staphisagroïdine, $C_{20}H_{20}NO_2$, which bears the same relationship to staphisagroïne that staphisagrine bears to delphinine. Staphisagroïne does not give the colour reactions of the other *Delphinium* alkaloids.

—A. C. W.

Alkaloids of Anagyris Fœtida. M. Klostermann. Inaug.
Diss. Marburg, 1898; Chem. Centr. 1899, **1**, [21], 1130.

By extraction of the seeds of *Anagyris fœtida* with 60 per cent. alcohol containing about 5 per cent. of acetic acid, then distilling off the alcohol, treating the aqueous extract of the residue with lead acetate, and decomposing the precipitate with sulphuretted hydrogen, a crude alkaloidal mixture is obtained consisting of cytisine and anagyrine. The alkaloids are separated by treating the hydrochloric acid solution with mercury chloride, the anagyrine being precipitated in the form of a double chloride, whilst the cytisine remains in solution. Anagyrine could not be obtained in a crystalline form, but cytisine forms white needles from ligroin (petroleum spirit), m. pt. 152°—153° C. From a comparison of the properties of cytisine and of anagyrine, the author concludes that anagyrine is butylcytisine.—A. S.

Cocaine Hydrochloride. B. H. Paul and A. J. Cownley.
Pharm. J. 1899, **62**, [1511], 524—525.

The authors controvert the statement of Guenther, that the crystalline precipitate produced by MacLagan's test for the purity of cocaine hydrochloride is due to isomeric ethylbenzoylecgonine and not to cocaine. Operating upon pure synthetic cocaine hydrochloride, they show that the crystalline base obtained by that test melts at 97° C. in Roth's apparatus, and that is the m. pt. of pure cocaine. Guenther states that his isomeride melts at 111° C. The critical point of MacLagan's test, which has been much discussed of late, is the solubility of cocaine in water. As the test was originally given, 1 grain of cocaine hydrochloride was directed to be dissolved in 2 fluid ounces of water, or 0·8925 of alkaloid to 875 of water, or 1:980. The exact solubility of cocaine in water cannot be determined by the ordinary methods, since in the presence of water it gradually undergoes decomposition into benzoylecgonine, especially when an alkali is also present. The only practical method of determining the solubility of the base under the conditions of MacLagan's test is to note the precise point in the ratio of water to base at which the crystalline precipitate ceases to appear. This, operating with the hydrochloride prepared from pure synthetic cocaine melting at 97° C., was found to be about 1:1500 at 15·5° C., and not 1:704 as stated by Guenther. The authors conclude, therefore, that the crystalline precipitate obtained by MacLagan's test is cocaine; that the solubility of that alkaloid in water is not greater than the conditions of the test prescribe. They reiterate that a specimen of cocaine hydrochloride which will not answer this test is not suitable for medicinal use.

—J. O. B.

The Aloïns. E. Léger. Comptes Rend. **128**, [23], 1401—1403. (See also this Journal, 1898, 866.)

Aloes from Natal, after exhaustion with acetone, gave up to boiling methyl alcohol a substance which was deposited on cooling in yellow plates. This, fractionally crystallised from methyl alcohol, yielded two substances, the more soluble "*nataloïn*," and the less soluble "*homonataloïn*," the latter in the greater quantity.

Nataloïn crystallises in pale yellow lamellæ, less soluble than barbaloïn in methyl alcohol, almost insoluble in water or ether; it exhibits the phenolic character of barbaloïn, dissolving in caustic but not in carbonated alkalis; it dissolves in ammonia or in pyridine; in hydrochloric or hydrobromic acid it dissolves less easily than barbaloïn, in acetic acid only on long heating. Analysis points to the formula $C_{16}H_{15}O_7$. With acetyl chloride it gives derivatives, but the carbon content of different acetyl derivatives is not sufficiently different to make distinction safe. Benzoyl chloride, with the pyridine solution of the substance, gives a tri-derivative, which, when heated in sealed tubes with excess of the chloride, is converted into a tetra derivative, so that nataloïn contains four hydroxyl groups.

Homonataloïn crystallises in plates of a deeper yellow than nataloïn. It yields an acetyl derivative with acetyl chloride, and the same tribenzoyl and tetrabenzoyl derivatives as nataloïn, so that it, too, contains four hydroxyl groups. It is possibly the methylic ether of nataloïn.

Both of these substances give the following reactions, and are thus distinguished from barbaloïn:—The sulphuric acid solution with a fragment of manganese dioxide or potassium chromate gives a fine green coloration; and the solution in soda, with a crystal of ammonium persulphate, gradually turns violet; this dyestuff dyes silk, but not mordanted cotton.—J. T. D.

Lemon-grass Oil, The Three Aldehydes of. W. Stiehl. J. für prakt. Chem. 1899, **59**, [11, 12], 497—516. (See also this Journal, 1898, 1069 and 1899, 67.)

The author has made further experiments and still maintains his opinion that three isomeric aldehydes exist in lemon-grass oil, and may be prepared from the latter by means of suitable bisulphite solutions.—A. S.

Lemonals (Citrals), The Nature of the Isomerism of the two. L. Bouveault. Bull. Soc. Chim. 1899, **21**, [9], 423—427.

Lemon-grass oil contains two isomeric aldehydes $C_{10}H_{16}O$; the semicarbazone of *a*-lemonal melts at 164° C., of *b*-lemonal at 171°; bases partially transform the former aldehyde into the latter, acids partially transform the latter into the former. Lemon-grass oil contains more *a*-citral than *b*-citral. It is not yet demonstrated that this is a case of stereochemical isomerism, the two aldehydes may differ in a purely chemical manner, in the position of a double bond.—A. C. W.

Lemon-grass Oil, The Isomeric Aldehydes of. L. Bouveault. Bull. Soc. Chim. 1899, **21**, [9], 419—423.

The separation of the isomeric semicarbazones of citral may be effected by repeatedly exhausting the crude product with boiling ether. The solution gives crystals melting at 135° C., the residue, after washing with ether until its melting point reaches 160°, gives on recrystallisation from alcohol, plates melting at 171° C., and the alcoholic mother liquors yield needles melting at 160°. When the mixture of semicarbazones obtained from citral prepared by different methods, or the mixture obtained from the same sample by different processes is subjected to this method of separation, the same products are obtained, but in widely varying amounts.

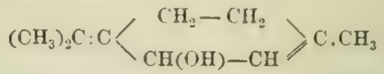
The semicarbazone melting at 135° is a mixture of 1 part of the compound crystallising in small plates with 1·5—2 parts of that crystallising in needles. (Compare this Journal, 1899, 170.) The author concludes that citral is not a homogeneous substance, the isomeric aldehydes it contains have been called *a*- and *b*-citral by Tiemann, and stable and unstable limonal by Barbier and Bouveault.—A. C. W.

Citral, A Polymer of. H. Labbé. Bull. Soc. Chim. 1899, **21**, [9], 407—408.

Alkalis readily polymerise citral. If 100 c.c. of 1 per cent. alcoholic potash be added drop by drop to 10 grms. of citral, the temperature rises 7°—8° C. and the odour disappears. On diluting and extracting with ether, a brown oil is obtained, which, after standing *in vacuo* for a month and in a desiccator for a year, showed signs of solidifying. The oil was then dissolved in benzene and precipitated by petroleum spirit as a yellowish-white powder. This softens at 75° C., and melts at 81°—82°; it is a polymer of citral. —A. C. W.

Citral, Action of Acids upon. A. Verley. Bull. Soc. Chim. 1899, **21**, [9], 408—413.

Citral is transformed into cymene by the action of acids. The author has isolated an intermediate product by the following method:—500 grms. of citral, 2 kilos. of ethyl acetic ester, and 500 grms. of 50 per cent. sulphuric acid were shaken until a homogeneous liquid was obtained. This was neutralised by soda, then washed, and the acetic ester distilled off. The residue, 400 grms., still containing much unaltered citral, was again treated by the same process, and the product fractionated *in vacuo*, about 60 grms. were obtained, boiling at 96°—97° C. under 12 mm. pressure. This substance, $C_{10}H_{16}O$, had the density 0·946, and index of refraction $n_D = 1·397$. It dissolves sodium with evolution of hydrogen, has an agreeable odour more distinct than that of citral, and recalling orange and bergamot. Dehydrating agents convert it into cymene. It could only be obtained by the action of sulphuric acid in the presence of ethyl acetic ester. Its formula is—



$$(CH_3)_2C:C\left\langle\begin{matrix} CH_2-CH_2 \\ CH(OH)-CH \end{matrix}\right\rangle C.CH_3$$

Tiemann (Ber. 1893, 279) has obtained geraniol by reducing citral with alcohol and sodium. The author has not been able to isolate a substance of constant boiling point from the products of the reduction of citral by sodium under the most varied conditions. By reduction with zinc in acetic acid solution, a yield of 30 per cent. of the glycol of citral, $C_{20}H_{32}(OH)_2$, was obtained. This boils at 203°—205° C. under 15 mm. pressure.—A. C. W.

Cerium, The Quantitative Separation of. G. Wyrouboff and A. Verneuil. Comptes Rend. **128**, [22], 1331.

See under XXIII., *page* 711.

Chlorates, The Decomposition of, with Special Reference to the Evolution of Chlorine and Oxygen. W. H. Sodeau. Proc. Chem. Soc. **15**, [212], 157—158.

See under VII., *page* 684.

Tartar, A Modification of Kaemer's Method for the Analysis of. G. Lombard. Staz. sperim. agrar. ital. **32**, 123; Chem. Centr. 1899, **1**, [19], 1086.

See under XXIII., *page* 713.

Cocaine Tests. E. Merck. Pharm. Zeit. **44**, 367; Pharm. J. 1899, **62**, [1511], 523.

See under XXIII., *page* 713.

Salicylic Acid, Methods of Determining. W. Fresenius and L. Grünhut. Zeits. anal. Chem. 1899, **38**, [12], 292.

See under XXIII., *page* 714.

PATENTS.

Carbonate of Iron, Impts. in the Manufacture of. C. Hoy, Ladybank. Eng. Pat. 7465, April 10, 1899.

The entire process of the manufacture of ferrous carbonate, as well as the storage in bottles, is conducted in chambers in which air is replaced by carbonic acid gas, supplied from a gasometer. Three contiguous cisterns are set over a fire-place, at a certain elevation to one side of the closed chambers, one containing de-aërated water; the second, ferrous sulphate solution; and the third, solution of an alkaline carbonate or bicarbonate, which are run in suitable order into a sliding tank within the chamber. An agitator is used which can be elevated out of the tank when the precipitation is completed. A fire-place open to the air is set below the enclosed tank. Provision is made for running off the solution above the precipitate, which can then be agitated with water, and so washed as completely as may be required. The precipitated ferrous carbonate is dried by heat from below, steam being removed by a pump. A close chamber adjoins that containing the tank, into which the sliding tank containing the dried precipitate is drawn. Manipulation and bottling are effected within this chamber by means of extensible air-proof gloves, into which the operator's hands can be introduced from outside without admitting air.—E. S.

Stoppering Ether and other Medical Bottles, Impts. in. E. K. Irwin, London. Eng. Pat. 11,746, May 24, 1898.

The stopper has a horizontal pin or projection, which, when the stopper is placed in the neck of the bottle and partly rotated, engages under the horizontally bent end of an upright pin fixed on the neck of the bottle, thereby locking the stopper in position.—R. A.

Carbonic Acid Ethers and Intermediate Products therefor, New Process for Producing. H. E. Newton, London, From Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 14,364, June 29, 1898.

When phosgene, perchlormethyl formate, $ClCO.OCCl_3$, or hexachlordimethyl carbonate, $CO(OCCl_3)_2$, reacts with a pyridine base, new compounds, the "chlorocarbonyls," $CO(C_5H_5NCl)_2$, are produced. These substances react with fatty alcohols, phenols, or acid phenolic esters to produce carbonic esters. The two processes mentioned are claimed, together with the "chlorocarbonyls," as new articles of manufacture.—A. C. W.

Dihydroionone and its Homologues, Manufacture of. W. Krauth, Griesheim a/M., Germany. Eng. Pat. 6141, March 21, 1899.

The cyclo-linaloolene of Semmler (Ber. **27**, 2520), on treatment with permanganate, forms the glycol—

$$C_8H_{16}:C.OH.CH_2.OH.$$

"By suitable means," this substance is converted into the aldehyde $C_8H_{16}:CH.CHO$, 2·2·6-trimethyl-cyclohexane-1-methylal. The patentee claims the process for the production of dihydroionone and its homologues, which consists in condensing the above aldehyde with acetone and its homologues by means of sodium ethylate in alcoholic solution, neutralising, expelling alcohol, and steam distilling.
—A. C. W.

Mercuric Phenolparasulphonate with Ammonium Tartrate. Manufacture of a Compound of. O. Imray, London. From F. Hoffmann, La Roche and Co., Basle, Switzerland. Eng. Pat. 6797, March 29, 1899.

The manufacture of a compound of mercuric *p*-phenolsulphonate and ammonium tartrate by dissolving mercuric oxide in *p*-phenolsulphonic acid, adding tartaric acid, neutralising with ammonia, and evaporating to dryness, is claimed. The compound, $C_{12}H_{10}O_8S_2Hg.4C_4H_4O_6(NH_4)_2 + 8H_2O$, is also claimed; it is said to be free from the disadvantages of mercuric chloride as a surgical antiseptic.
—A. C. W.

XXI.—PHOTOGRAPHY.

Monochromatic Light, A Source of Intense. C. Fabry and A. Perot. Comptes Rend. 1899, **128**, [19], 1156—1158.

For optical purposes the author recommends the use of the electric arc of mercury *in vacuo*. The spectrum of the light emitted by this arc is identical with that of mercury vapour in tubes, and comprises a violet, a green, and two yellow rays. For monochromatic purposes, it is necessary to isolate the ray desired, by absorbing the others by suitable media. For photography, a practically monochromatic light is obtained by absorbing the ultra-violet with quinine sulphate, the action of the green and yellow rays on the plate being negligible. A more powerful, but less fine, source of this light is obtained by striking an arc between a positive mercury surface and a carbon pole.
—J. F. B.

The Specific Absorption of the X-Rays by Metallic Salts. A. Hébert and G. Reynaud. Bull. Soc. Chim. 1899, **21**, [9], 394—402.

The authors have compared the absorptive powers of aqueous solutions of metallic salts for X-rays, with that of a column of water of equal height. They draw the following general conclusion. The absorptive power of a substance for the X-rays increases, in a general way, with the increase of atomic weight. In the case of a compound, it is that element of which the atomic weight is highest, which confers upon the compound its absorbent powers, whether that element be electro-positive or electro-negative.—A. C. W.

Photographic Developers, Bromine Substitution Compounds as. L. Cramer. Phot. Mittheil. 1899, **36**, 164; through Chem. Zeit. Rep. 1899, 164.

The author finds that halogen substitution compounds have many advantages over the aromatic bodies containing simply hydroxyl or amido groups, which have hitherto been employed or investigated as photographic developers. In particular, the bromine derivatives of quinol (hydroquinone) and pyrogallol, are much more energetic than the original substances; the former gives softer negatives, and the latter is among the most rapid reducing agents known They are prepared by mixing together calculated proportions of the quinol or pyrogallol with free bromine, both dissolved in benzene; a second crystallisation ensuring purity. Chlorine compounds behave similarly.—F. H. L.

Nitrocellulose, Estimation of unaltered Cellulose in. G. Lunge and E. Weintraub. Zeits. für angew. Chem. 1899, 473.

See under XXIII., *page* 714.

XXII.—EXPLOSIVES, MATCHES, Etc.

Wood Meal and Wood Flour, Definition of. Papier-Zeit. 1899, **24**, [51], 1941.

"Wood meal" or "wood flour" consists of wood shavings, &c., which have been so finely ground as to pass through a sieve of 50 meshes per inch; 30 per cent., at the most, should pass through a 100-mesh sieve. The wood should not have been exposed to acid vapours, nor overheated in drying, and should not contain more than 5 per cent. of moisture. The variety known as "wood meal" serves for the absorption of nitroglycerin in the manufacture of explosives; whilst "wood flour" is used for the manufacture of a certain kind of linoleum.—A. S.

Nitrocellulose: Researches on its Constitution and Formation. G. Lunge and E. Weintraub. Zeits. f. angew. Chem. 1899, 441—448, and 467—475.

The authors briefly summarise the results of their researches as follows. The amount of nitrogen present in the nitrocellulose is here expressed as c.c. of NO at 0° C. and 760 mm. pressure per 1 grm. of substance.

The pentanitrocellulose produced by the action of a mixture of concentrated sulphuric and nitric acids, is insoluble in a mixture of ether and alcohol (Vieille). The solubility of such a nitrocellulose commences when the proportion of nitrogen corresponds to 190 c.c. of NO per 1 grm. (The proportion of NO corresponding to a nine-fold nitrated cellulose is theoretically 190·95 cc. NO.) The assumption that in this product there is present a chemical individual, *viz.*, the ennea-nitro cellulose (nine-fold nitrated cellulose) is at least as well established as Eder's assumption of a tetra- or tri-nitrocellulose. By employing methods, however, according to which the nitrocellulose was brought into solution, it was found possible to arrive at nitro derivatives of the simple cellulose, corresponding in percentage of nitrogen to pentanitrocellulose, and soluble in ether and alcohol, or even in alcohol alone.

Effect of varying the Proportions of Acids Employed for Nitration.—By increasing the proportion of H_2SO_4, the rapidity of the action is greatly diminished. With a mixture of 1 part of H_2SO_4 and 4 parts of HNO_3, or even with equal amounts of the two acids, the end point is reached in 30 minutes, but with 3 parts of H_2SO_4 and 1 part of HNO_3, the amount of nitrogen after 30 minutes corresponds to only 202·9 c.c., compared with 213·74, when the reaction is complete; with 8 parts of H_2SO_4 and 1 part of HNO_3, the action is not complete in 8 days. When the process is retarded, the proportion of nitrogen in the final product is diminished. The influence of temperature becomes greater with increase in the proportion of H_2SO_4 in the mixed acids. When the proportion of H_2SO_4 to HNO_3 is more than 8 : 1, the final product even after one month consists of unaltered cellulose. The proportion of H_2SO_4 also influences the structure of the nitrocellulose; with pure HNO_3 or with the addition of very little sulphuric acid, the fibres contract and become much stronger, but when a large proportion of H_2SO_4 is employed, the cellulose is disintegrated, by nitration and drying, to a fine fibrous powder.

The maximum content of nitrogen is secured when in the treatment of the cellulose a mixed acid is employed containing $\frac{1}{4}$ part by weight of sulphuric acid to 1 part of nitric acid (1·52). A nitrocellulose thus obtained furnished 214·61 c.c. of NO, and represents the highest degree of nitration attained by the authors with a nitro-sulphuric acid mixture. Vieille obtained in his results a product yielding 214 c.c. The theoretical figure for an Endecanitrocellulose (eleven-fold) is 215·17 c.c. NO for 1 grm.

The authors then conclude with Vieille, that the highest step of nitration distinctly attained by the nitro-sulphuric acid mixture is represented by the eleven-fold (Endeca)-nitrocellulose. But the results point to the collateral presence of some little Hexanitrocellulose, and hence, as the authors point out, the existence in some small proportion of twelve-fold nitrocellulose must be conceded.

Influence of Temperature.—When employing a mixture of 3 parts of H_2SO_4 and 1 part of HNO_3 it is found that (1) the rapidity of the reaction increases with rise of temperature. At 0° C. the nitrogen corresponds to 170·75 c.c. after 30 minutes; at the ordinary temperature 202·9 c.c. At 40° C. the reaction is complete in 30 minutes and at 80° C. in 15 minutes. (2) The greatest possible nitration diminishes from 213·5 to 208·9 with rise of temperature from ordinary to 40° C. but with a further rise to 60° C. or 80° C. it remains almost constant. (3) With rise of temperature, more and more of the product is dissolved in the acids and thus lost. (4) Increase of temperature alters the structure, the product becoming short in fibre and brittle. Nitrocellulose produced at 60°—80° C. is disintegrated, on drying, to a fine powder.—R. B. B.

Explosive, New. A. Defraiteur. Rev. Prod. Chim. **2**, [5], 66—67.

THE one preparation (which is claimed as safe from accidental explosion) consists of :—ammonium nitrate, 82—89 parts; nitro-dextrin, 10—15 parts; and resin, 1—4 parts. The gaseous products of the explosion of the mass are free from carbon monoxide.

In the second class of safety explosives for use in fiery mines, mixtures of ammonium nitrate and nitrodextrin are employed, the best results having been furnished by the proportion of 7—20 parts of nitrodextrin to 93—80 parts of ammonium nitrate.—C. S.

Explosive and Detonating Substances, New. Alvisi. Rev. Prod. Chim. **2**, [6], 83.

THE author proposes to employ ammonium perchlorate as an addition to explosives or in substitution of their oxidising components, its effect being—so it is claimed—to increase the explosive and propulsive force, as well as the ratio of the former to the latter. He divided the explosives into three classes; kratites, nitrokratites, and polykratites, the first named being designed for detonators, the nitrokratites—nitro-explosives with an addition of ammonium perchlorate—for firearms and industrial purposes, whilst the third class comprises a large series wherein ammonium perchlorate is substituted for potassium perchlorate, chlorate, or nitrate, sodium nitrate or chlorate, barium nitrate, or other oxidising constituents of ordinary explosives.

The substitution is made in molecular proportions, based on the amount of oxygen displaced: but the quantity of ammonium perchlorate added may also be varied according as the complete or incomplete combustion of the carbon in the mass is desired.

The increase in the temperature of ignition of the explosive, ensuing on addition of ammonium perchlorate, necessitates more powerful detonators, but may be counteracted by adding sulphur, antimony sulphide, or other metallic sulphides.—C. S.

Ammonium Nitrate Explosives, Use of Potassium Chlorate in. H. L. Chatelier. Comptes Rend. **128**, [23], 1394—1395.

AMMONIUM nitrate explosives, so useful in mines from their low temperature of detonation, are apt to miss fire. This defect can be remedied by the addition of potassium chlorate, but the danger of mixing is very great, and the action of the chlorate somewhat irregular. Ammonium nitrate and potassium chlorate are isomorphous, however, and experiments of the author show, that by using a mother-liquor containing the two salts in proportions determinable by trial, and dissolving the salts in this in determinate quantities, a salt of a uniform composition, and containing any desired percentage of chlorate, can be crystallised out. Such a substance, from its uniformity of composition, and from the method of its preparation, would seem suitable for use as an explosive.—J. T. D.

Nitrocellulose, Estimation of Unaltered Cellulose in. G. Lunge and E. Weintraub. Zeits. für angew. Chem. 1899, 473.

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PATENTS.

Shot Firing in Coal and other Mines, An Improved Method of Obtaining Increased Safety in. C. H. Curtis, D. J. Metcalfe, A. F. Hargreaves, and A. C. Pearcy, London. Eng. Pat. 12,404, June 2, 1898.

THE patent is claimed for the use of potassium bicarbonate in connection with gunpowder or other blasting explosive charge, as a cooling agent for extinguishing flame or incandescent particles (this Journal, 1899, 400). The bicarbonate may be incorporated with the explosive in the process of manufacture, or mixed in the form of crystals with the finished product; in the latter case, the most suitable size is such as will pass through a sieve of six mesh. A permeable mass or a pellet composed of crystals of the bicarbonate contained in a separate compartment within the cartridge or tamped in the bore hole may also be employed. When mixed with the gunpowder, from 33—50 per cent. of bicarbonate is a suitable amount, but when separated from the explosive charge a larger quantity may be used.

—E. W. W.

Matches, Impts. in or relating to. R. T. Maguire and D. P. Maguire, Waterloo, Lancashire. Eng. Pat. 13,466, June 16, 1898.

THE improvement in the manufacture of matches is effected by first dipping the splints in a composition, which will, when ignited, produce sufficient flame to fire the splint, but which will not ignite by rubbing, and secondly, dipping the extreme ends of the heads with a substance containing only a small amount of phosphorus preferably amorphous phosphorus, which will ignite on any surface. A convenient mixture for the first paste contains 10 parts of gum or glue or a mixture of both, 30 of potassium chlorate, 3 of potassium bichromate, 6 of flowers of sulphur, 25 of flour glass, and 6 of red lead. Instead of the glue, gum, and potassium chlorate, 25 parts of whiting, 9 of resin, and 6 of kieselguhr may be used. The second paste consists of 6 parts of yellow or amorphous phosphorus, 40 of potassium chlorate, 5 of potassium bichromate, 10 of sulphur, 10 of antimony sulphide, and 30 of dextrin and water. The proportion of phosphorus in such a mixture is too small to cause necrosis and amounts to only ½ per cent. of the head. The pastes are made by converting the gum, glue, or dextrin, into a jelly with water, and then adding a mixture of the other ingredients with water. Matches made in this way are not liable to accidental ignition by pressure, or friction between the heads.—E. W. W.

Matches, Impts. in the Manufacture of. W. G. Cordes, London. Eng. Pat. 14,175, June 27, 1898.

MATCHES which will strike on any surface are prepared from a paste containing 200 parts of potassium chlorate, 100 of ground glass, 60 of whitening, 35 of plaster of Paris or cement, 130 of glue (8 of glue to 8 of water), 30 of water and 1 of a dyestuff. To this paste, after thoroughly mixing and passing twice through the mill, a mixture of 50 parts of amorphous phosphorus with sufficient water to form a paste of the consistency of cream, is added. The whole is thoroughly mixed, and finally passed through a mill, the rollers of which have been previously eased.—E. W. W.

Matches, Impts. in the Manufacture of Inflammable Pastes suitable for. H. Sevène and E. D. Cahen, Paris. Eng. Pat. 16,314, July 26, 1898.

THE patent is claimed for (1) the use of phosphorus sesquisulphide, P_4S_3, in inflammable pastes for matches; (2)

pastes containing phosphorus sesquisulphide, oxidising material, inert matter, and glue; and (3) a paste made of 90 parts of phosphorus sesquisulphide, 200 of potassium chlorate, 110 of peroxide of iron, 70 of zinc white, 140 of powdered glass, 100 of glue, and 290 of water. The matches ignite readily on all surfaces without explosion, and can be easily transported. The sesquisulphide which may be obtained in a state of purity by distillation, is a very stable compound, resists moisture as well as atmospheric agents, and can be easily utilised and manipulated industrially (see this Journal, 1898, 1181, and 1899, 73).—E. W. W.

Matches, Impts. in the Manufacture of. O. Lindner, Nüremberg. Eng. Pat. 3237, Feb. 14, 1899.

Non-poisonous and scentless matches which can be ignited by rubbing on any surface, but are not readily inflamed by rubbing together, are made by using two pastes of different explosive powers. The lower enlarged portion of the match head is made by dipping in a low explosive mixture of 6 parts of potassium chlorate, 2 of sulphide of antimony, 1½ of gum, 1½ of pulverised clay or umber and water. After drying, these heads are tipped by dipping in a highly explosive mixture of 6 parts of phosphorus, 2 or 3 of potassium chlorate, 1½ of dextrin, 1½ of aniline with milk and water, the milk and the aniline serve to somewhat reduce the explosive character of the mixture.—E. W. W.

Base for Igniting Compounds, more particularly for Use in the Manufacture of Matches, Manufacture of a. E. F. Trachsel, Reval, Russia. Eng. Pat. 7114, April 4, 1899.

The patent is claimed for (1) the manufacture of a base for igniting compounds consisting mainly of lead hyposulphite (thiosulphate) mixed with an alkali bichromate. In certain cases the lead hyposulphite may be wholly or partly replaced by other lead salts such as the acetate. (2.) A process of manufacturing such a base by mixing lead hyposulphite, potassium bichromate and water with or without the addition of sulphur, antimony sulphide, manganese peroxide, and the like. When the reaction is complete, which is shown by the mixture no longer coagulating glue, potassium chlorate and a binding material, such as glue, gum arabic, or gelatin are added. (3.) The use of the above base in the manufacture of matches.

When 30 parts of lead hyposulphite are stirred with 9 of potassium bichromate and 15—30 of water, the mixture gradually changes from yellow to red, and the greater sensitiveness of the product is probably due to the formation of lead bichromate. A suitable paste for matches consists of 20—30 parts of lead hyposulphite, 6—9 of potassium bichromate, 60 of potassium chlorate, 6—8 of sulphur, 6—8 of antimony sulphide, 5—8 of manganese peroxide, and 6—10 of glue. The matches will ignite on any surface, bear transport well, even when not tightly packed, and require a tolerably high temperature for ignition.—E. W. W.

Explosive Compounds, Impts. in. J. O'Brien, Gunn, San Francisco. Eng. Pat. 2149, Jan. 31, 1899.

The patent is claimed for (1) an explosive compound consisting of a mixture of ground mineral coal, *i.e.*, any form of coal from which illuminating gas is at present manufactured, with a suitable chemical adapted to produce a heat sufficient to liberate and ignite the gases contained within the coal; (2) an explosive compound or blasting powder containing 22 parts of mineral coal, 63 of sodium nitrate, and 15 of sulphur; and its manufacture (3) by grinding the ingredients to a certain size, preferably so that the particles will pass through a sieve having 50—100 meshes to the inch, and then mixing in a dry state; or (4) by immersing the mixture of ground coal and sodium nitrate with sodium chloride in water, boiling until dry, care being taken to avoid caking, and then mixing with finely-ground sulphur; or (5) by a process similar to the preceding, except that the water is not boiled, but evaporated at about 160° F. The most perfect nitration is obtained by boiling. The ingredients, when mixed dry, are preferably ground separately, but they may be ground together without deleterious effect. In ordinary packages, such as boxes or cans, this compound will not explode or detonate, as the solder will melt before sufficient heat is generated to evolve the gases from the coal, but in a confined space its explosive power is stated to be equal to, if not greater, than that of any of the known explosives.—E. W. W.

Explosive, An Improved. A. J. Brown, Matlock. Eng. Pat. 3247, Feb. 14, 1899.

An explosive, which is stated to be practically flameless and to have explosive powers equal to "carbonite," is manufactured by mixing 4 parts by weight of turpentine oil "or its chemical equivalent," with 1 of collodion cotton, heating in a water-bath at about 40° C., then adding 30 parts of nitroglycerin, and raising the temperature to 75°—80° C. The "gelatin" thus formed is mixed with 40 parts of potassium nitrate, 27 of Epsom salts, and 1 of soda, and worked up into cartridges, &c. The soda serves to neutralise any acetic or formic acid produced by oxidation of the turpentine. —E. W. W.

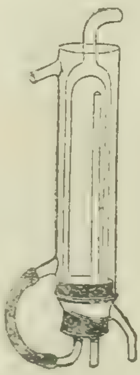
XXIII.—ANALYTICAL CHEMISTRY.

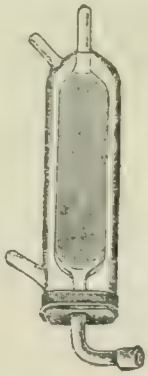
APPARATUS, ETC.

Condensers, Two New. J. C. Thresh. The J. of State Med. 1899, 7, [6], 372—373.

The condensers figured below are for laboratory purposes, and intended to supplant the Liebig condenser, which the author describes as an "admittedly cumbersome piece of apparatus."

The first form consists of three concentric tubes. The condensing water passes to the top of the innermost tube, leaving it below by a rubber tube, to enter the outermost cylinder, whence it overflows into a waste pipe. The vapour to be condensed enters at the top, passes between the inner and middle tubes, and leaves by a tubulure at the bottom.

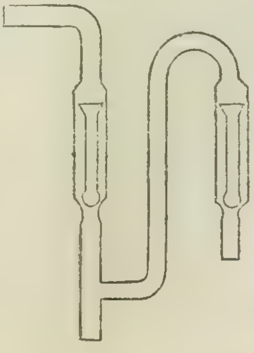




The second form of condenser is a modification of the Liebig, intended to be used in a vertical position, in which the condensing tube is blown out and flattened, thus exposing a large condensing surface.—H. T. P.

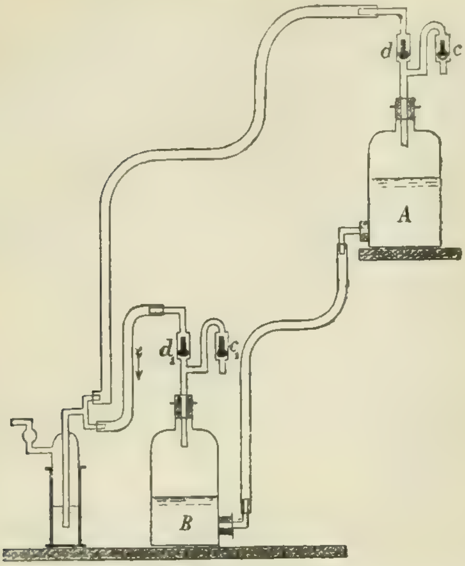
A New Aspirator. A. Rosenheim. Ber. 1899, 32, [10], 1831—1833.

Fig. 1.

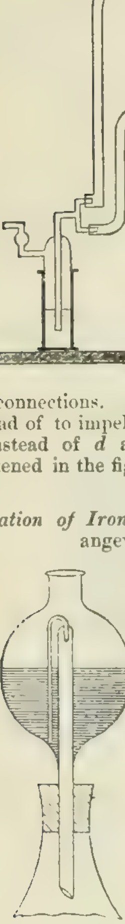


The simple glass valve (Fig. 1) is the chief addition to the ordinary simple aspirating apparatus. The glass rods with rounded ends make valves which are absolutely tight to small pressures from one side, but readily moved by slight pressure from the other. The aspirator (Fig. 2) consists of two large bottles connected by rubber tubing: the decrease of pressure in A opens c and closes d, whilst the increase of pressure in B closes c_1 and opens d_1, the current passing in the direction of the arrow. When A is empty, the positions of the flasks are simply changed, without altering any connections. If it be required to draw a current of air instead of to impel one, the ⊤-piece is connected to c and c_1, instead of d and d_1. (The rubber tubing is shown shortened in the figures.)—A. C. W.

Fig. 2.



Titration of Iron, Apparatus for. H. Göckel. Zeit. f. angew. Chem. 1899, **26**, 620—621.



This is a simplified form of the apparatus described by Contat (Chem. Zeit. 1898, 298). Instead of the well-known rubber valve, a siphon tube is used dipping into an outer vessel containing a saturated solution of sodium carbonate. As the flask cools down, after reduction is complete, the sodium carbonate is sucked in until sufficient carbonic acid is evolved to equalise the pressure. The ferrous salt is consequently in an atmosphere of carbonic acid. The possibility of the breaking of the flask under reduced pressure is also removed.
—G. W. McD.

Saccharometers, Officially Tested. H. Classen. Zeits. angew. Chem. 1899, [21], 496—497.

The author has bought saccharometers certified correct by the "Aichungscommission," and tested them, using all the prescribed directions for cleanliness, against pycnometer weighings. He found differences of 0·2° to 0·4° Brix., and his results were confirmed by the Verein d. Deutsch. Zuckerind. Cleaning the instruments with alcohol and ammonia did not improve the correctness of their readings, and only after using mechanical means (fine kieselguhr) for cleaning purposes did the results correspond. The differences again appeared when he attempted to use them for two successive determinations with only the usual washing in alcohol and water between each. The author is of opinion that certified saccharometers are not fit for factory work, owing to the trouble entailed in cleaning them, if any result more accurate than that afforded by an ordinary instrument be desired, and he remarks that for fine chemical work the pycnometer is invariably employed.
—J. F. B.

Indicators, Classification and Use of. F. Glaser. Zeits. anal. Chem. 1899, **38**, [12], 273—278.

The following is a suggested classification of the more important indicators :—

Group I. (sensitive to alkalis).

(*a*) Tropaeolin 00.
(*b*) Methylethylorange, Dimethylamido-azobenzene.
(*c*) Congo Red, Benzopurpurin, Iodo-eosin, Cochineal.
(*d*) Lacmoid.

Group II.

(*a*) Fluoresceïn, Phenacetolin.
(*b*) Alizarin, Orseille, Hæmatoxylin, Galleïn.
(*c*) Litmus.
(*d*) *p*-Nitrophenol, Guaiacum tincture.
(*e*) Rosolic Acid.

Group III. (sensitive to acids).

(*a*) Tropaeolin 000.
(*b*) Phenolphthalein, Turmeric, Curcumin W, Flavescin.
(*c*) a-Naphtholbenzeïn.
(*d*) Poirrier's Blue C_4B.

The above indicators are all either of acid or saline nature, and the classification is based upon the strength of the acid radicle contained in each. Members of Group I. are of strong acid nature, consequently they react readily with bases forming stable salts; they are not sensitive to weak acids. The acid character of the indicators in Group III. is only weakly marked, consequently they are but slightly sensitive to bases; their salts are unstable and easily decomposed by acids. Members of Group II. are intermediate in character between those of Groups I. and III. The table is so drawn up that the sensitiveness of the successive indicators to alkalis decreases as the sensitiveness to acids increases.

The knowledge of the position of an indicator is of importance when bodies are titrated whose basic or acid character is not well marked, *e.g.*, the salts of the mineral acids with alumina, carbonates, silicates, &c. Further, the table enables us to determine to some extent the nature and strength of an acid or base by titrating it with the help of different indicators, *e.g.*, if one acid can be readily titrated with the help of either lacmoid or litmus, and another only with the latter, then the two acids must be of different strengths.

When titrating formic acid, lacmoid is a fairly good indicator, but litmus is better; with acetic acid a member of Group III. must be used. Here we have a confirmation of the fact that among homologous organic acids with the same number of carboxyl groups, the acid character diminishes with increasing molecular weight.

In titrating alkalis the rule holds good that an indicator only shows the end of a reaction sharply when the product of the change is neutral. The change of colour is only sharp when strong fixed bases are used; ammonium salts being readily hydrolysed by the water present. When very dilute solutions of the fixed bases are used, the colour change is often not sharp; this is due more to the hydrolytic action of the water on the indicator than on the salt formed.

Hydrolytic changes in presence of indicators of Group III. are frequently ascribed to the influence of carbon dioxide in the air. The author shows experimentally that the fading of the colour of a weak alkaline solution containing phenolphthaleïn is due to the hydrolytic action of the water present and not to atmospheric carbon dioxide.
—E. H. T.

INORGANIC CHEMISTRY.—QUALITATIVE.

Chlorates, Bromates, and Iodates, Separation and Detection. D. Vitali. Boll. Chim. Farm. **38**, 201—209; Chem. Centr. 1899, **1**, [19], 1084.

Bromates and iodates are precipitated by means of silver nitrate, which should not be used in excess, whilst chlorates remain in solution. The precipitate is washed on the filter, then suspended in water, and treated with sulphuretted hydrogen. The silver sulphide is filtered off, the sulphuretted hydrogen removed from the filtrate by gentle warming, the liquid neutralised with caustic soda, and concentrated. In this solution, iodine is detected by means of nitrite and sulphuric acid, and quantitatively extracted by chloroform. In the residue, bromine is detected by means of chlorine water.—A. S.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Phosphorus Hydride, Estimation of, in Gaseous Mixtures. A. Joannis. Comptes Rend. **128,** [22], 1322.

The experiments show that the estimation of phosphorus hydride in gaseous mixtures by means of cupric sulphate is only practicable in the absence of gases which are absorbed by cuprous salts and in the presence of more than 2 molecules of cupric sulphate for each molecule of phosphorus hydride.—C. O. W.

Nickel, Colorimetric Estimation of. M. Lucas. Bull. Soc. Chim. 1899, **21,** [9], 432—433.

Potassium and ammonium sulphocarbonates give a red coloration with nickel salts. Under the same conditions cobalt salts give a brown coloration which is much more intense with ammonium sulphocarbonate than with the potassium compound. In the analysis of steel, 0·5 grm. of metal is dissolved in aqua regia, and iron is precipitated and reprecipitated by ammonia and ammonium chloride. The solution is diluted to 500 c.c. To two quantities of 50 c.c., 10 c.c. of ammonium and potassium sulphocarbonate respectively are added. If cobalt be present, the coloration is browner in the first case than the second, and the two metals must be separated by ordinary processes. If cobalt be absent, the depth of colour is compared with the coloration given by a nickel nitrate solution containing 0·1 grm. of nickel in 1 litre. Copper is found by boiling off ammonia and adding potassium ferrocyanide, if present it should be separated by sulphuretted hydrogen.

The ammonium sulphocarbonate solution is prepared by digesting freshly prepared ammonium sulphide with 5 per cent. by weight of carbon bisulphide for 21 hours. Fresenius prepares potassium sulphocarbonate by saturating a 5 per cent. caustic potash solution with sulphuretted hydrogen, adding an equal volume of caustic potash and digesting at a gentle heat with 4 per cent. by volume of carbon bisulphide. The two solutions should be adjusted to give the same intensity of coloration with the standard nickel solution.—A. C. W.

Nickel and Zinc, Studies on the Separation of. E. Doehler. Chem. Zeit. 1899, [37], 399.

The author did not get satisfactory results by titrating zinc with sulphide of sodium in ores, containing nickel, and therefore endeavoured to find out a better method. 0·25 grm. of pure zinc was dissolved in 10 c.c. of aqua regia, the solution evaporated, and the residue dissolved with a little hydrochloric acid, and then filled up to 250 c.c. 1 grm. of pure nickel sulphate was acidulated with HCl and made up to 1,000 c.c.

(1.) 50 c.c. of the zinc (=0·05 grm. Zn) and 25 c.c. of the nickel solution were evaporated together until nearly dry, then diluted with water and neutralised with ammonia. 1 grm. of sodium acetate and 20 c.c. of acetic acid were added, the solution was warmed to 60° C. and saturated with H_2S. The greater part of the nickel precipitated with the zinc. After four hours' standing the precipitate was filtered through a double filter, washed with H_2S-water, and extracted with HCl containing H_2S. About four-fifths of the precipitated Ni remained undissolved on the filter. The zinc solution was evaporated nearly to dryness. Ammonia, 1 grm. of acetate of soda and 30 c.c. of acetic acid were added, and the solution at 60° again saturated with H_2S. Pure white ZnS precipitated and was filtered off and dissolved in HCl. A trace of Fe and Al was removed with NH_3 and the zinc then titrated with sulphide of sodium.

(2.) 50 c.c. of Zn solution, 50 c.c. of Ni, 1 grm. of acetate of soda, 30 c.c. of acetic acid, were manipulated as in Experiment 1.

(3.) Used 40 c.c. of acetic acid; the first precipitate was filtered, dried, ignited, dissolved in HCl, brought to 300 c.c. and neutralised with NH_3. Then 1 grm. of acetate of soda and 30 c.c. of acetic acid were added and the solution saturated with H_2S. The ZnS heated in a current of hydrogen, was weighed and a check was made by re-dissolving the ZnS and titrating with sulphide of soda.

(4.) In place of acetate of soda and acetic acid, formiate of soda, 0·2 grm., and formic acid (5 c.c.) were used. The ZnS was absolutely white and kept its colour, it was treated like in 3, again formiate of soda 0·2 grm., and formic acid 3 c.c. being used for the second precipitation.

The results obtained were as follows :—

—	Taken.	Found.
	Grms. Zinc.	Grms.
1	0·0500	0·0470
2	0·0500	0·0506
3	0·0500	0·0500 and 0·0496
4	0·0500	0·0489 and 0·0470

The author satisfied himself that no zinc was left in the filtrate of the ZnS. He prefers method No. 4. For technical purposes the second precipitation with H_2S can be dispensed with.—S K.

Bromine Present in Chlorides, Estimation of Traces of. H. Baubigny. Comptes Rend. 1899, 128, [19], 1160—1163.

In the separation of bromine from chlorides by distillation with copper sulphate and permanganate (this Journal, 1899, **18,** 176), the results are only correct if not more than a certain quantity of chlorides are present, and if, as when mere traces of bromine have to be estimated, a considerable quantity of the chloride be taken, some of the chlorine passes over along with the bromine. The process of oxidation is therefore conducted in the cold, and the distillation is carried out at the ordinary temperature under vacuum. Under these conditions only a minimum quantity of chlorine is liberated during the short period of the operation. The liquid in the condenser, containing all the bromine and a little chlorine, is then again oxidised and distilled, this time at a high temperature, according to the general method, *loc. cit.*—J. F. B.

Bromine, Separation and Determination of Traces of, in Presence of a Great Excess of Chlorine. H. Baubigny. Comptes Rend. **128,** [20], 1236—1239.

The author finds that his method of determining bromine (this Journal, 1899, 176) can be improved on by substituting for the mixture of permanganate and copper sulphate, permanganate alone, to which is added a drop or two of hydrochloric acid. The chlorine liberated is sufficient to completely liberate in turn the whole of the bromine, and the distillation is completed in 15 or 20 minutes after the water bath attains a temperature of 98°—100° C., if the current of air has been passing from the time at which the temperature was 50° C., or thereabout. Tests in which accurately weighed quantities of 3 or 4 mgrms. of potassium bromide were added to 12 grms. of common salt gave absolutely accurate results. It would indeed seem that the method is capable of determining the bromine, if it be present in appreciable quantity, no matter how small its relative proportion may be.—J. T. D.

Chlorine, The Estimation of Traces of, in Presence of a very Large Excess of Bromine. H. Baubigny. Comptes Rend. **128,** [22], 1326.

The observation made by several writers that by the action of bromine upon chlorides, small quantities of chlorine are liberated, does not hold good for solutions very poor in chlorides. It is therefore possible to expel from such solutions all the bromine, without affecting the chlorides present, by means of a mixture of potassium permanganate and cupric sulphate. This mixture acts according to the equation $24\,KBr + 8\,KMnO_4 + 21 CuSO_4, 5\,aq = 12\,Br_2 +$

$5\,[CuSO_4 + 3\,Cu(OH)_2] + 16\,K_2SO_4 + Cu\,(Mn_4H_{10}O_5)_2 + 87H_2O.$

The process is carried out by adding to the solution of the substance to be analysed, the solution of the cupric sulphate, and subsequently that of the permanganate. The bromine liberated is at first carried off by an air current in the cold, and its expulsion subsequently completed by boiling, until fluorescein paper is no longer affected by the steam of the boiling liquid, which will then be found to contain all the chlorine present in the original substance. —C. O. W.

Cyanides, Estimation of Sulphides in. J. Loevy. J. of the Chem. and Metallurg. Soc. of South Africa, 1899, **2**, 54—55.

THE red-violet colour produced by sodium-nitroprusside with small quantities of sulphides is now put forward for the colorimetric determination of the quantity present in potassium cyanide. Three solutions are required:—(1) A solution of 40 grm. of $Na_2S, 9H_2O$, in 1,000 c.c. to which about 0·2 grm. of caustic soda is added to preserve the sulphide from decomposition, 1 c.c. of which solution should theoretically contain 0·0053 grm. of sulphur, but actually a little less; (2) A solution of 44·15 grms. of $ZnSO_4, 7H_2O$, in 1,000 c.c., 1 c.c. containing 0·01 grm. of zinc; and (3) a solution of 5 grms. of sodium nitroprusside in 100 c.c. of water, to which four to six drops of a 5 per cent. solution of potassium cyanide are added.

The strength of the first solution is volumetrically determined by the second, the indicator consisting of a piece of paper which has been dipped into ferric chloride, and afterwards into very dilute ammonia, and which is placed in the zinc solution. Comparisons are then made in cylinders between the cyanide sample and pure cyanide, to each of which 1 c.c. of the third solution is added. The characteristic coloration produced in the sample is equalled and measured in the pure cyanide by adding drop by drop the sulphide solution diluted with water as 1 : 10. The limits for this method are between 0·0005 and 0·0015 per cent. of sulphur in the solution. The coloration within these limits will last from 10 to 30 minutes. If below the limit, it is indistinct and disappears too rapidly, and if above, it is too dark, and the cyanide solution must be diluted accordingly. The sulphide solution does not decompose if the bottle is full and kept in darkness.—A. W.

Silicates, The Decomposition of, by means of Boric Anhydride. P. Jannasch and H. Weber. Ber. 1899, **32**, [10], 1670—1675.

IN a former communication (this Journal, 1896, 220) this new method for the analysis of silicates was introduced. The process was found to be susceptible of general application, except in the case of *cyanite* (aluminium silicate), which is not decomposed by boron trioxide by prolonged fusion over the blowpipe. This mineral is also but little attacked by a mixture of hydrofluoric and sulphuric acids, or by ammonium fluoride. Complete decomposition by boron trioxide may be effected by means of the oxygen-coal gas blowpipe. For this purpose gas is taken from 3—6 ordinary taps to a blow-pipe provided with a jet 2·5 mm. wide, oxygen is supplied from a cylinder. A wide flame must be used, and care taken to make the lower portion as little luminous as possible. A mixture is carefully made of 0·5 grm. of *cyanite* in the finest powder, with 15 grms. of powdered boric anhydride. This is heated first over the ordinary flame, and then over the blowpipe, to gentle fusion. Two to three grms. of the anhydride are added, and the crucible is finally heated over the oxygen blowpipe until a clear glassy melt is obtained. Not more than 15 minutes are required. On cooling, the mass must remain clear, a cloudiness would indicate separation of silica, which would prolong the subsequent solution. The red-hot crucible is quenched in cold water, the melt thrown into a porcelain dish, at once treated with a mixture of strong hydrochloric acid and methyl alcohol, and heated to boiling over a small flame. In 10—15 minutes a clear solution is obtained, this is evaporated to dryness. The residue is then evaporated to dryness with hydrochloric acid and methyl alcohol to remove all traces of boric acid. The small quantity of the melt remaining in the crucible is dissolved in the same manner and added to the remainder of the solution. Analyses of *cyanite* and a quartz porphyry gave concordant results by this method.

Topaz is readily decomposed under the influence of the oxygen blowpipe, the fluorine is evolved as boron fluoride. The method may be employed for the estimation of silica in fluorspar and cryolite. A mixture of pure cryolite and silica treated by this process gave practically the theoretical weight of silica; silicon fluoride does not appear to be formed.—A. C. W.

Lead-Tin and Lead-Antimony Alloys, Quick Testing of. J. Richards. J. Franklin Inst. **147**, [5], 398—401.

THE author's apparatus consists of a balance with a graduated arm and moveable weight, which is calibrated by carefully casting standard bullets of lead-antimony alloys of known composition, containing between 2 and 24 per cent. of antimony. The weights of similar bullets of unknown alloys furnish at once the compositions of the alloys. Alloys containing less than 2 per cent. of antimony are denser than lead, so that the balance cannot be used for them; they can, however, be distinguished from pure lead by pouring a small button on a flat surface to cool—the solidified surface is frosted and crystalline as long as any antimony is present, but perfectly smooth when the button is pure lead.

A precisely similar apparatus serves for the determination of tin in tin-lead alloys; but here it can be applied throughout the whole range, from pure lead to pure tin, with a delicacy of discrimination of about 0·25 per cent.

A similar balance serves for testing coated roofing-plates. A piece of plate is cut to a template, and the balance beam so graduated that the weight of a box of 20 × 28 plates in lbs. is read off. The sample is then heated, and all the melted coating wiped off. The difference between the original weighing and a re-weighing gives the weight of the coating per box.—J. T. D.

Copper, Analysis of the Deposit separated during the Electrolytic Purification of. A. Hollard. Ann. Chim. anal. appl **4**, 123—125; Chem. Centr. 1899, **1**, [19], 1082.

THE deposit consists of gold, silver, and salts of arsenic, antimony, lead, bismuth, copper, selenium, and tellurium, and is valued according to the amount of gold, silver, and copper it contains. Four samples were found to contain—

	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Silver	25·8160	31·5210	36·480	46·5800
Gold	0·0337	0·0768	0·102	0·1504
Copper	18·4750	24·0420	18·516	18·4750

For the determination of the gold, 12·5 grms. of the dried and pulverised deposit are carefully heated in a crucible with 50 grms. of litharge, 10 grms. of nitre, 25 grms. of calcined soda, and 15 grms. of fused, pulverised borax to quiet fusion, then a mixture of 20 grms. of litharge, and 0·4 grm. of charcoal added, and the determination proceeded with in the usual manner.

For the determination of silver and copper, 5 grms. of substance are heated in a porcelain crucible in a current of dry chlorine. From the residue, the copper is dissolved by nitric acid, and precipitated electrolytically (this Journal, 1897, 66). The silver chloride is dissolved out by potassium cyanide solution, and deposited by electrolysis during 24 hours with a current of 0·5 ampère.—A. S.

Copper, Method for the Rapid Determination of, for Use in the Vineyard. M. Zecchini. Staz. sperim. agrar. ital. **32**, 117—122; Chem. Centr. 1899, **1**, [19], 1085.

THE author estimates volumetrically the copper in commercial copper sulphate by means of the following solutions:—(1.) A solution containing 19·878 grms. of sodium thiosulphate, and 8 grms. of ammonium sulphocyanide per litre. The copper is reduced to the cuprous state by the thiosulphate, and is then precipitated as cuprous sulphocyanide. (2.) A solution containing 20—25 grms. of potassium iodide, and 5·089 grms of iodine per litre. This solution serves for the titration of the excess of thiosulphate. It has been shown that neither the excess of ammonium sulphocyanide nor the separated copper sulphocyanide react with the iodine solution. (3.) A solution of 20 grms. of crystallised copper sulphate per litre. Two volumes of the second solution should correspond to one volume of the first.

In applying the method, 60 c.c. of the first solution are agitated with 50 c.c. of the third solution, starch solution added, and the liquid titrated back with the second solution. Solutions (1) and (3) correspond to one another in equal volumes. The method is stated to give sufficiently accurate results.—A. S.

Cerium, The Quantitative Separation of. G. Wyrouboff and A. Verneuil. Comptes Rend. **128**, 1331.

Mixtures of the rare earths containing more than 50 per cent. of Ce_3O_4 are dissolved in nitric acid with addition of hydrogen peroxide in small quantities. This solution is precipitated with a mixture of ammonia and hydrogen peroxide, evaporated on the water-bath, and then for a few moments heated over the naked flame until acid vapours begin to be given off. The remaining mass is dissolved in nitric acid and the solution evaporated over a small flame to a syrupy consistency, dissolved in water (150 c.c. for 0·5 grm. of oxide), boiled, and mixed with 1 c.c. of a 5 per cent. solution of ammonium sulphate. The precipitate is filtered off, washed, and ignited at white heat. The filtrate while hot is mixed with 0·05 grm. of ammonium persulphate and 1 c.c. of a 50 per cent. solution of sodium acetate and boiled. The precipitate is treated like the one first obtained. The two quantities of Ce_3O_4 thus obtained represent the whole present in the analysed mixture. If the quantity of cerium present be less than 50 per cent., the oxides may be dissolved in nitric acid, the solution be evaporated to the consistency of syrup, and the process be completed as above described. If the quantity of cerium present be very small, say from 10 to 15 per cent., it suffices to treat the solution in nitric acid immediately with a few centigrams of ammonium persulphate and a little sodium acetate.—C. O. W.

ORGANIC CHEMISTRY.—QUALITATIVE.

Cotton-Seed Oil, The Halphen Test for. D. Holde and R. Pelgry. Chem. Rev. Fett- u. Harz-Ind. **6**, [4], 67—68; [5], 94—95. (See this Journal, 1899, 611; also 1897, 1045.)

The authors find that none of the following oils—olive oil, rape oil, fish oil, hemp oil, earth-nut oil, castor oil, almond oil, sesame oil, mustard-seed oil, poppy oil, and American pale mineral lubricating oil—answer to the Halphen colour reaction when pure. Some care is necessary in the case of fish oils, since these, under the influence of heat during the test, change colour and acquire a slight reddish tinge. This, however, can be distinguished from the Halphen reaction by allowing the oil to run in a thin stratum over the surface of the tube, whereupon the acquired tinge due to the fish oil itself will disappear, the coloration due to cotton-seed oil being persistent under the same conditions.

On investigating the effect on the reaction of heating the oil before the test. The authors further found that heating the oil for 10 minutes at 250° C., renders it incapable of producing the colour change, although with oil heated to 200°—210° C. the reaction is merely weakened, as reported by Soltsien (this Journal, 1899, 611). Hence the test is useless for detecting adulterations with cotton-seed oil that has been heated to about 250° C.—C. S.

Sumac, Detection of Various Adulterants in. Rev. Prod. Chim. **2**, [3], 35.

Pistachio can be detected by boiling 0·5 grm. of powdered substance in a tube with 5 c.c. of 18 per cent. caustic potash (sp. gr. 1·155). The colour of the extract will be brown with a violet tinge, turning to dark brown on dilution with water, whereas the pure substance furnishes a yellow-brown solution, becoming paler when diluted.

The ash of tamarisk contains 20·129 per cent. of sulphur trioxide, this adulterant can be detected by the white precipitate given by barium nitrate with the liquid obtained by boiling 1 grm. of the suspected sumac in 100 c.c. of water for half an hour and acidifying the filtered solution with nitric acid.—C. S.

Methyl Alcohol in Spirits, Method for Detecting. A. Trillat. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9], 870—871. (This Journal, 1898, 879.)

The method for detecting methyl alcohol in ethyl alcohol requires to be slightly modified when applied to spirits and liqueurs.

50 c.c. of the product to be tested are diluted with an equal quantity of water, and 8 or 10 grms. of slaked lime added. In the case of absinthe or liqueurs containing essences precipitable by water, the liquid, after dilution with water, is filtered through a layer of char, to separate the greater part of the essence. It is then distilled in an ordinary bulb apparatus and the first 25 c.c. are diluted with water to 150 c.c. after the addition of 70 c.c. of sulphuric acid (1 : 5). To oxidise the mixture, 30 grms. of powdered potassium bichromate are added and the whole is allowed to remain for an hour. It is distilled over a flame from a 200 c.c. flask with a short neck. The first 25 c.c. are rejected, as they contain much acetaldehyde; the distillation is continued until 100 c.c. are obtained. For the test, 50 c.c. of the distillate are poured into a small flask, and 1 c.c. of dimethylaniline added. It is a necessary precaution that this should be carefully rectified. After mixing the contents, the flask is corked and placed in a water-bath at 70° to 80° C., for 3 hours, shaking 3 or 4 times during this time. After the liquid is rendered distinctly alkaline with caustic soda lye, it is distilled over a flame to remove excess of dimethylaniline. Generally, on distilling drop by drop, the dimethylaniline is eliminated after 25 c.c. have passed over, but this must be ascertained, as its presence would interfere with the subsequent reaction. Oxidation is effected by adding about 10 c.c. of acetic acid and then 4 or 5 drops of a liquid containing, suspended in it, 2 grms. of finely divided dioxide of lead per litre of water. No notice need be taken of the colour until after boiling, when a deep blue colour will indicate the presence of methyl alcohol in the original liquor. The absence of the blue coloration is an indication of the absence of methyl alcohol.

To make the test quantitative, a comparison is made colorimetrically with a standard.—L. J. de W.

Methyl Alcohol in Natural or Compound Liqueurs; Formation of Acetals in Liqueurs. A. Trillat. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [9] 871—877.

It was of interest to find whether the method for detecting methyl alcohol (see preceding abstract) could be used to solve the question, often raised, of the existence of this alcohol in a natural state in certain liqueurs, and to test its applicability to the various spirits of commerce.

The first step was to find if natural or compound liqueurs, such as brandy, rum, absinthe, bitters, &c., contained ethers or essences capable of giving condensation products with dimethylaniline.

A large number of samples were examined, but with the exception of four Marcs du Midi and three inferior spirits, none gave the blue coloration capable of resisting heat. The transient blue colour given by many was found to be due to the presence in the spirits of aldehydic derivatives of the type of acetals. This leads to the conjecture that certain spirits, particularly old liquors, contain acetals formed by the combination of acetic aldehyde with ethyl alcohol, while those of the type $CH_2(OR)_2$ were not found in any of the liquids examined. The natural aromas of spirits and the products employed as bouquet have no influence on the reaction.

On adding one part of methyl alcohol to 500 of the sample previously examined, the presence of the alcohol was at once detected, whence it is concluded that methyl alcohol does not exist in the free state in genuine spirits, even in rum.—L. J. de W.

Oxycelluloses, Some Colour Reactions of. E. Jandrier. Comptes Rend. **128**, [23], 1407—1408.

A few centigrammes of a phenol are placed in a test-tube, 1 c.c. or 2 c.c. of the solution of the oxycellulose (or of the liquid containing it in suspension) are added, and about 1 c.c. of strong sulphuric acid, quite free from nitrous compounds, is carefully poured down the sides of the tube, so as to mix as little as possible with the other liquid. At the surface of separation of the liquids a coloration appears, either at once or on gently warming. Phenol gives a golden-yellow colour; α-naphthol, violet; β-naphthol and hydroquinone, brown; resorcinol, yellow-brown; menthol and thymol, rose-tints, dependent on the temperature; gallic acid, green, turning violet underneath in the sulphuric acid, morphine and codeïne, rich violet. All these colours vary somewhat with the concentration of the oxycellulose solution, and resemble those obtained under the same conditions from the aldehydic sugars, from dilute solutions of gum arabic, or from formaldehyde.—J. T. D.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Colours [White Lead] Ground with Oil, Determination of Water in. H. Forestier. Ann. Chim. anal. appl. **4**, 114—118; Chem. Centr. 1899, **1**, [21], 1138.

The amount of water in white lead ground with oil cannot be determined by simple drying at 100° — 110° C., as the oil takes up oxygen, whilst the lead reacts with the oil with separation of glycerin. The author recommends, as giving constant results, drying for 10—12 hours in an oil-bath at 105° C. in a current of hydrogen.—A. S.

Indigo, The Valuation of. W. Holtschmidt. Zeits. für angew. Chem. 1899, 451—455 and 475—479.

Three methods of estimating the comparative value of samples of Indigo are considered, their limitations and defects are described, and certain improvements suggested.

Permanganate Method.—In this method there are two chief sources of error, *viz.*, too strong heating during sulphonation with consequent formation of sulphurous acid; and the uncertainty of the end reaction. The first difficulty may be avoided by adding to the concentrated sulphuric acid 40 per cent. of its weight of phosphoric anhydride, no external heat is then required, the formation of the di-sulphonic acid taking place in about two hours with a very slight rise of temperature. The second defect may be overcome by determining the end of the reaction by turbidity instead of by colour. The permanganate is added in drops at a constant rate until the liquid appears very pale green, and on stirring, a dark cloudiness is observed. Two or four drops at a time are then added with very slight stirring to avoid disturbing the turbidity. When no more cloudiness is produced, the amount of permanganate used is read off and 0·1—0·2 c.c. subtracted according as two or four drops have been added in excess. The permanganate must be run in slowly, and the Indigo solution must not be too dilute. The disturbing influence of varying light may be avoided by always using a petroleum lamp, a method of lighting which cannot be employed when titrating for colour in the usual manner.

By previous extraction of the Indigo with dilute hydrochloric acid and with a mixture of alcohol and ether, as proposed by Donath and Strasser (Zeits. f. angew. Chem. 1894, 49; this Journal, 1894, 426), the errors due to indigo-gluten and Indigo-red are avoided, these alone, and not Indigo-brown, being the substances, according to the authors named, which influence the results. A number of analyses made by the author's improved permanganate method without previous extraction, show differences from estimations of the same samples by Donath and Strasser's method (with titration by permanganate for *colour*), which in no case exceed 0·6 per cent., the limit of error of the latter process. Comparative dyeing trials were made with a number of indigo samples, using amounts of each such that equal weights of indigotin were employed. All the samples thus dyed the same shade, those dyed with extracted indigos showing bright and even colours, while the unextracted indigos gave paler, duller, and uneven colours. It is evident that for dyeing trials, the Indigo should be extracted.

Colorimetric Method.—Owing to the great dilution of the solutions employed in this method, the presence of indigo-gluten or Indigo-red has practically no influence. The results are only correct to within about 2 per cent. By a large number of experiments with Grosse's polarisation colorimeter, the author shows that the method only serves for the comparison of Indigos of a similar class, because the tone of colour of the solutions varies so widely in different Indigos.

Analysis by Nitrogen Estimation.—It was proposed by Voeller (Zeits. f. angew. Chem. 1891, 110; this Journal, 1891, 488) to remove the Indigo-gluten, Indigo-red, and Indigo-brown by extraction with hydrochloric acid, alcohol, and dilute caustic potash respectively, and to estimate the nitrogen in the residue by Kjeldahl's method, calculating from this the percentage of Indigotin. The author finds this method to be only suitable for a few superior varieties of Indigo, because in the medium and lower qualities a considerable amount of impurities exist, which contain nitrogen, and are not extracted by the solvents employed. A sample of "fine Bengal" Indigo, manufactured by a new method, the so-called "Coventry process," also gave abnormal results, apparently for the same reason.—R. B. B.

Isovaleric and Acetic Acids, Method for the Quantitative Separation of. A. C. Chapman. Analyst, 1899, **24**, [278], 114—116.

After alluding to the difficulties met with in the quantitative separation of isovaleric and acetic acids by the ordinary methods, the author recommends a process which depends on the fact that sodium valerate is fairly soluble, but sodium acetate insoluble in a solution containing 99·5 parts of acetone and 0·5 part of water.

The mixture of acids is carefully neutralised with a solution of pure caustic soda, and the water then distilled off under reduced pressure, the slight loss of valeric acid which usually occurs when solutions of the metallic valerates are evaporated in contact with air, being avoided in this way. The residue is dried in the air-bath at 100° C., and heated with the requisite quantity of 99·5 per cent. acetone for some minutes just to the boiling point, a piece of glass tubing passing through a cork in the neck of the flask serving to prevent the loss of any appreciable amount of acetone. The liquid is filtered through asbestos, and the insoluble residue washed with acetone. The acetone is distilled off from the filtrate, the residue washed into a platinum dish, evaporated to dryness, treated with sulphuric acid, and weighed as sodium sulphate. The insoluble sodium acetate is dissolved in water, and treated in a similar manner. Figures are given showing the accuracy of the method.
—A. S.

Glue and Leather, The Analysis of. W. Fahrion. Chem. Zeit. **23**, [43], 452.

In 1895, the author suggested the use of an alcoholic solution of caustic soda as a suitable reagent for the separation of albumins and gelatins ("Leimgebendensubstanzen") from other organic compounds, and he found it especially useful in the analysis of glue. For the estimation of fat in the latter substance, 10 grms. of finely powdered glue are digested in a porcelain dish on the water bath with 40 c.c. of an 8 per cent. solution of alcoholic caustic soda. The mixture is constantly stirred until the alcohol is completely evaporated, when the residue is treated with a small quantity of hot water. The products from the gluten, together with the sodium salts of the fatty acids and oxy-fatty acids, are completely dissolved, the residue being inorganic in nature and easily soluble in hydrochloric acid. This acidified solution is then heated for half an hour almost to boiling, washed into a separating funnel, and, when cool, shaken with ether, and allow to stand overnight. The ethereal solution contains the fatty acids and the liquid oxy-acids. The acid aqueous solution is drawn off below, leaving behind any solid oxy-acid in the funnel, this being easily extracted with warm alcohol. The ethereal and alcoholic solutions are mixed together, evaporated, the residue weighed, ignited to ash, and again weighed, the difference expressing the fat contained in the sample. A similar method can also be used for the estimation of grease in leather or in chamois leather.

The author gives the following method:—2·5 grms. of finely-powdered leather are treated with petroleum ether to extract the adherent grease, the residue is then treated with 10 c.c. of an 8 per cent. solution of alcoholic caustic soda, or with 20 c.c. of normal caustic soda solution, and 30 c.c. of strong alcohol, as in the case of the glue. The residue is treated with hot water; the tanning material and the hide substance being completely dissolved. Any residue is of inorganic character. The equivalent amount of acid is now added to neutralise the soda, and the tanning material is mostly precipitated. On cooling, the liquid is filtered through a weighed filter and washed with slightly acidified water; the contents of the filter are dried at 105°, weighed, powdered, extracted with ether, and the residue reduced to ash. The weight of the filter contents minus the portion soluble in ether and the ash, gives the "insoluble tannin." The portion soluble in ether is the combined fat which has become oxidised and has united with the leather, as it has been demonstrated by Knapp and Eitner, and later by Simand, that grease exerts a tanning effect upon leather.

The author gives the two following results obtained by the above method :—

——	Sole Leather.	Calf Leather.
Water	12·45	12·82
Ash	0·83	0·55
Uncombined fat	0·52	27·68
Combined fat	0·38	1·04
Insoluble tannins	32·40	21·68
Soluble tannin Hide substance Organic non-tannins	53·42	36·23
	100·00	100·00

—J. G. P.

Beetroots, Direct Analysis of, by Cold Aqueous Digestion. J. Zamaron. Bull. de l'Assoc. de Chim. de Sucr. et de Dist. 1899, **16**, [9], 885.

See under XVI., *page* 696.

Glycerin in Fermented Liquids, Determination of. J. Laborde. Ann. Chim. anal. appl. **4**, 110—114. Chem. Centr. 1899, **1**, [19], 1086. (See also this Journal, 1899, 524.)

If the liquid contain 5—20 grms. of sugar per litre, the sufficiently diluted liquid is well agitated with 2 grms. of slaked lime, which has been moistened with alcohol. If the mass does not harden, a further addition of slaked lime is made, and the whole exhausted with the alcohol ether mixture. With liquids containing more than 20 grms. of sugar per litre, a quantity is taken corresponding to 5—6 grms. of sugar, agitated with lime which has been made into a paste with 10—20 c.c. of 50 per cent. alcohol, boiled with 100—200 c.c. of 80 per cent. alcohol, and after cooling, an aliquot part, about four-fifths of the whole, drawn off. This portion, after addition of tartaric acid, is freed from alcohol, and treated as a liquid free from sugar. The method is stated to give satisfactory results with liquids containing large quantities of sugar.

It was found that organic impurities in the glycerin obtained, either do not influence the results, or can be removed without loss of glycerin by means of bone charcoal.—A. S.

Ash, A New Method of Estimating. A. E. Shuttleworth. Inaug. Diss. Göttingen, 1899, 46.

The substance is treated with a solution of calcium acetate, and heated over a Bunsen burner in a specially constructed platinum vessel contained in a deep cylindrical sand-bath which is surrounded by a conical iron screen. The latter is provided with a flat iron cover with a central hole through which a chimney of combustion tubing passes.

It is stated that the process is much shortened and that the caustic lime produced in the ignition assists the combustion by preventing fusion. Volatilisation of chlorides is also prevented.

In the ordinary method of preparing ashes, excessive heat is liable to partially fuse the ash. Such an ash is not completely attacked by hydrochloric acid, and is liable to furnish too high and variable results for silica. The crude silica obtained from fused ashes retains bases, probably in the form of double silicates.—N. H. J. M.

Fat in Milk, Source of Error in Modifications of the Leffmann-Beam Method for the Estimation of. H. Droop Richmond and F. R. O'Shaughnessy. Analyst, 1899, **24**, [279], 146—148.

In the Leffmann-Beam centrifugal method of fat estimation, the amyl alcohol is mixed with an equal volume of hydrochloric acid, the effect being to ensure a thorough distribution of the former throughout the milk, by the curdling action of the hydrochloric acid, before the sulphuric acid is added.

In Gerber's modification of the method, hydrochloric acid is omitted, the sulphuric acid is put in first, next the amyl alcohol, and finally the milk. As, however, the results are vitiated, if the sulphuric acid and amyl alcohol be left long in contact, Gerber recommended as an alternative method to first add the acid, then the milk, and finally the amyl alcohol.

The authors have found that when the acid and amyl alcohol were accidentally shaken up together (Gerber's original method being followed) before adding the milk, the fat obtained on centrifugalising was frequently highly coloured, and the resulting estimation was invariably higher than when the acid and amyl alcohol were not allowed to mix. The effect was much more pronounced on very hot days, whilst in cold weather it practically disappeared. It is stated that when amyl alcohol and strong sulphuric acid are mixed, an action takes place resulting in the formation of a liquid compound which is insoluble in a more dilute acid, whilst a mixture of sulphuric acid, water and amyl alcohol does not result in the formation of such a compound. The action between sulphuric acid and amyl alcohol increases at higher temperatures.

The authors have investigated the different modifications, and conclude :—

(1.) To obtain correct results with the Gerber method, it is advisable to always add first the sulphuric acid, then the milk, and finally the amyl alcohol.

(2.) The modification in which amyl alcohol is added first has a tendency to give high results, and in hot weather the error may assume serious proportions.

(3.) Gerber's original method—adding first sulphuric acid, then amyl alcohol, and finally the milk—gives good results in the hands of a careful operator, but may, at times, give rise to error.—A. S.

Tartar, A Modification of Kaemer's Method for the Analysis of. G. Lombard. Staz. sperim. agrar. ital. **32**, 123—126; Chem. Centr. 1899, **1**, [19], 1086.

In order to obviate the long evaporation, and washing with alcohol in Kaemer's method, the author proceeds in the following manner, which is stated to give good results :—The tartar is accurately neutralised, the solution made up to 200 c.c., filtered, 20 c.c. of the filtrate treated with 1—1·5 c.c. of acetic acid, then with a mixture of equal parts of 98 per cent. alcohol and ether, the whole well mixed and allowed to settle for 3—4 hours. After this time, the liquid can be readily decanted from the deposited tartar, the latter rapidly washed free from acid with alcohol ether, and titrated in the usual manner with normal alkali.—A. S.

Cocaine Tests. E. Merck. Pharm. Zeit. **44**, 367; Pharm. J. 1899, **62**, [1511], 523.

The author cannot recommend the chromic acid test for cocaine proposed by Schaefer (this Journal, 1899, 522), as the concentration of the hydrochloric acid employed appears to play the chief part in determining the precipitation of the chromate. With the same sample of cocaine hydrochloride, the addition of 10 per cent. hydrochloric acid will cause a turbidity, but with 7·5 per cent. acid, the solution remains clear; whilst another sample will answer the test with 10 per cent., but not with 12·5 per cent. hydrochloric acid. The author considers the Maclagan test is the best for indicating the purity of cocaine hydrochloride. The solubility of cocaine in water, determined by agitating the alkaloid for some hours with water at 24° C., and weighing the portion undissolved, was found, as the mean of two experiments, to be 1 : 1340. The whole of the alkaloid could not be recovered from its aqueous solution, by agitating with solvents, a portion having been converted into benzoyl-ecgonine. The solubility expressed on the alkaloid recovered from the aqueous solution gave a result of 1 : 2590.—A. S.

Salicylic Acid, Methods of Determining. W. Fresenius and L. Grünhut. Zeits. anal. Chem. 1899, **38**, [12], 292—301.

Of the following methods investigated, III. alone was found to give full satisfaction :—

I. Extracting with chloroform.
II. Iodine method (Messinger and Vortmann).
III. Titration with bromine (Freyer).
IV. Colorimetric, with ferric chloride.

I. A weighed quantity of pure sodium salicylate is dissolved in water, the free acid liberated with sulphuric acid and then extracted by shaking out four or five times with chloroform in a separating funnel. The extracts are collected, washed with a little water, evaporated in a weighing bottle, and weighed after being dried in a hot water oven. The figures obtained were too low, owing to the volatilisation of the salicylic acid during the drying. Various methods of shortening this operation did not lead to better results, but better ones were obtained by extracting with a mixture of ether and ligroin in equal volumes, and drying on the top of the oven. The objection to this modification is that the solution of salicylic acid in the solvent cannot be easily separated from the remaining liquid, as it is specifically the lighter.

II. An aqueous solution of the salicylate, containing free sodium hydrate, is heated to 50°—60° C., and then heated with an excess of a standardised iodine solution. On the liquid assuming a yellow colour, due to liberated iodine, the temperature is again raised to 50°—60° C., when a light-red precipitate forms, which increases in amount on adding dilute sulphuric acid. After cooling, the liquid is made up to a definite volume, filtered, and an aliquot part of the filtrate titrated with sodium thiosulphate. According to the authors of the method, one molecule of salicylic acid requires three molecules of iodine. Five estimations, made in the above manner, gave varying amounts of salicylic acid, the extreme limit of variation being nearly 30 per cent. Thus, this method is quite unreliable.

III. Bromine reacts with salicylic acid to form the compound $C_6H_2Br_4O$, one atom of bromine of which will liberate iodine from potassium iodide. The bromine, which must be in an excess of 75—80 per cent., is liberated from a solution of potassium bromide and bromate by hydrochloric acid; the amount of available halogen in the solution being determined by adding potassium iodide and hydrochloric acid and titrating the separated iodine.

The necessary quantity of bromide and bromate solution is diluted with 300 c.c. of water and treated with 30 c.c. of hydrochloric acid (sp. gr. 1·1). On the addition, with agitation, of the salicylic acid (in about 1 per cent. solution), a white precipitate is immediately formed. After standing 5 minutes, 30—40 c.c. of a 10 per cent. potassium iodide solution is added and the iodine set free titrated with $\frac{1}{10}$ N. sodium thiosulphate. In this titration the starch must not be added until most of the free iodine has been bound, otherwise some iodide of starch is adsorbed ("Adsorption") by the precipitated tribromphenol, and thus escapes titration. The same error is liable to occur if too great an excess of bromine be used, or if more than 5 minutes elapse before the iodide is added. For the same reason, water must not be used as solvent in determining salicylic acid in pharmaceutical preparations which contain that acid and starch or sugar. In such cases the substance should be dissolved in 90 per cent. alcohol, the solution made up to a certain volume, the undissolved starch filtered, and an aliquot portion of the filtrate used for titration.

This method gives excellent results; it cannot, however, be used in the analysis of wines.

IV. was found to be applicable only when the amount of salicylic acid did not exceed 2 mgrm.—E. H. T.

Nitrocellulose, Estimation of Unaltered Cellulose in. G. Lunge and E. Weintraub. Zeits. für angew. Chem. 1899, 473—474.

2—3 grms. of metallic sodium are dissolved in 100 c.c. of alcohol, and filtered if the solution is not clear. 100 c.c. of acetone are then added, 50 c.c. of the mixture are put aside, and the remaining 150 c.c. poured into a porcelain basin, and a weighed amount (about 5 grms.) of the nitrocellulose is introduced. The mixture is heated to 40°—50° C. with frequent stirring: the extraction is complete in 20—30 minutes. The residue is allowed to settle, and the brownish-red solution poured off through a small filter. The residue is washed with alcohol to remove small quantities of products formed by condensation between acetone and sodium ethylate, and then washed with water, when a brown substance is dissolved. After filtering, the residue is washed, first with hot water and then with water acidified with hydrochloric acid. The treatment described suffices when the proportion of unaltered cellulose is great, but when the amount is small, the residue is washed with alcohol and rinsed from the filter into a porcelain basin with the 50 c.c. of acetone, &c., which have been preserved, and heated for 15 minutes at 40°—50° C., then filtered through a dried and weighed filter, washed as before, dried at 100° C., and again weighed. The cellulose now remaining does not yield the slightest trace of nitrogen, and, since in the extremely delicate diphenylamine reaction it gives only a slight bluish tint, it may be considered sufficiently pure.
—R. B. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Distillation in a Vacuum, Notes on; with Remarks on the Behaviour of Liquids and Vapours formed in Vacuo. F. Krafft. Ber. 1899, **32**, [9], 1623—1635.

In a previous communication on this subject (Ber. **28**, 1253; this Journal, 1896, 214; Ber. **29**, 1316, 2240), the author showed that the boiling point of substances of high molecular weight, which melt without evaporating *in vacuo*, fell by at least 80° to 100° C. on the removal of the last 10 to 15 mm. of pressure; and also that the boiling point of bodies which are volatilised and again condensed in a vacuum, can be accurately determined with the aid of the vacuum of the cathode light.

Further experiments have shown that the distillation of substances of high molecular weight in a vacuum of the cathode light if a layer of vapour hang above the liquid, does not differ in principle from distillations under the ordinary pressure. This was shown by means of an apparatus consisting of a distillation flask, above the body of which were two large bulbs with electrodes fused into each. In the case of elaidic acid, for instance, which in the previous communication was stated to boil at 154° C. under a column of vapour of about 65 mm., a determination of the boiling point in this apparatus showed that at the commencement of ebullition (142° C.), the body of the flask only being filled with vapour, the cathode light in the tube behind the condenser was pure green, and in the two bulbs, the lower of which was some 40 to 60 mm. above the substance, the light was greenish-violet, pointing to the absence of vapours. When the column of vapour was about 70 mm., and the thermometer reached 155° C., the cathode light showed that the vapour was in the intermediate bulb, but had not reached the upper bulb some 25 mm. higher.

The conclusion arrived at by experiments with this apparatus was confirmed by the results of other experiments in which two thermometers were used, one being placed in the boiling substance and the other in the vapour a little way above it. In the case of palmitic acid, for example, it was found that the boiling point of the liquid in the vacuum was only about 1° higher than that of the vapour, which, at a height of 50 to 55 mm., was 136° to 137° C.

It was further proved that the boiling point of substances of high molecular weight in the vacuum of the cathode light was dependent on the height of the column of vapour produced. Thus, pentadecylphenylketone, $C_6H_5.CO.C_{15}H_{31}$, boiled at 161° C. with the column of vapour at 90 mm.; at 164·5° with vapour column 110 mm.; and at 176° C. with a column of 180 mm. For each 10 mm. increase in the height of the vapour, the boiling point was raised, on the average, by 1·66°.

The author considers that he has established the law that the boiling point under any given pressure must be regarded as a function of the molecular weight, quite independently of the pressure of the atmosphere (*cf.* Ber. **15**, 1721; and **17**, 1377).

The fact that the higher normal paraffins remain in a liquid state of aggregation in the vacuum of the cathode light depends on their molecular weight. These paraffins (hexadecane to pentatriacontane) have at their melting points nearly the same specific gravity. This is also true in the case of the higher olefines.

Olefine.	M.P.	Specific Gravity at Melting Point.	Boiling Point at 15 mm.	The Difference between the M.P. and B.P. increases with the Molecular Weight.
	° C.		° C.	° C.
Dodecylene ...	−31	0·7954	96	127
Tetradecylene	−12	0·7936	127	139
Hexadecylene.	+4	0·7917	155	151
Octadecylene .	+18	0·7910	179	161

The author considers that this can only be satisfactorily explained on the assumption that the molecules of such indifferent hydrocarbons do not exercise any polar attraction on each other, and therefore exist immediately above their melting point in a monomolecular and strictly comparable condition.

It was established previously (Ber. **15**, 1721) that the difference in temperature between the melting and boiling points of the higher normal paraffins increases with the molecular weight. Thus, heptadecane, $C_{17}H_{36}$, under a pressure of 15 mm. remains liquid for 147·5°. For each addition of CH_2, the paraffin under the same pressure remains liquid for 6° longer, and accordingly pentatriacontane, $C_{35}H_{72}(C_{17}H_{35} + 18(CH_2))$ remains liquid for 256°·3 observed, or 147·5 + 18 × 6 = 255°·5 calculated.

In other saturated homologous series a similar phenomenon may be observed. Thus, in the higher fatty acids, the substance remains liquid for about 4·6° C. for every increase of CH_2 in the series.—C. A. M.

Semipermeable Membranes, Practical Use of. B. Moritz. Chem. Zeit. 1899, [37], 400.

The fundamental phenomenon of semipermeability is due, as is known, to the difference which certain diaphragms exhibit to the rate of permeability on the part of the surrounding molecules. Precipitation-membranes which are formed when two solutions meet under certain precautions represent a special case of semipermeability. For instance, if a solution of ferrocyanide of potassium (0·1 grm. per litre) is carefully poured on the top of a copper sulphate solution (about 0·05 grm. in 1 litre) in an inclined test tube, the well-known transparent membrane of ferrocyanide of copper is formed where the two solutions meet, and soon begins to show osmotic separating effects. Concentration-currents in consequence of the osmotic pressure will be noticeable with the naked eye, or better, according to Tammann, with Toepler's apparatus. The instability of such membranes militates, of course, much against their practical use. But, by producing the precipitation-membranes in porous bodies (clay-cells) or parchment-paper, they will assume a more stable character, and by cooling the solutions at the same time, the process of precipitation and decomposition may be stopped, and thus such membranes might be made use of for analytical purposes. G. Tammann has already examined 17 organic colouring matters in this respect. Five of them permeate the ferrocyanide of copper membrane, 7 the ferrocyanide of zinc, and 11 the tannic acid-glue membrane. The tabulated salts of Ba, Sr, Ca, and Mg were tested by the same chemist in the case of a ferrocyanide of copper membrane, with the following result.

—	Cl_2.	Br_2.	$(NO_3)_2$.	S_2O_6.
Ba...............	Perm.	Perm.	Perm.	Imp.
Sr	"	"	Imp.	Perm.
Ca...............	Imp.	Imp.	"	Imp.
Mg	"	"	"	..

In concentrating solutions of a not very stable nature, such as glue or tannic acid, semipermeable membranes might be found serviceable. If ferrocyanide of copper were absolutely impermeable to $MgCl_2$, a glue solution inside a cell, prepared with the membrane, and surrounded by a concentrated $MgCl_2$ solution, might easily be concentrated, as water would pass from the glue to the $MgCl_2$ solution. The glue-tannate membrane might be suggested in the first place, but it seems that all metallic salts penetrate it. The purification of solutions might also be effected by the use of semipermeable membranes; indeed, osmotic methods have already been tried or suggested for the purification of molasses. Glue solutions permeate membranes of ferrocyanide of copper, glue-tannate, &c., but slightly. On the other hand, glue undergoes molecular and other changes when concentrated too far. Such changes might be estimated by the changes of the osmotic pressure, and the value of a glue might possibly be thus determined.

Besides precipitation-membranes, other substances exhibit semipermeability. Deville and Troost have observed that hydrogen at higher temperatures diffuses through platinum, iron, and palladium. India-rubber membranes behave similarly at ordinary temperatures with respect to other gases. Another kind of semipermeability takes place when three liquids meet, that are but incompletely soluble in each other. Thus, L'Hermite stated that osmosis occurred in an ether, water, and chloroform system; the volume of the latter increased as the ether diffused into it through the water.—S. K.

Silver Sulphide, Action of Hydrogen upon, and the Inverse Reaction. H. Pélabon. Bull. Soc. Chim. 1899, **21**, [9], 402—407.

Below 180° C., silver is not attacked by dry sulphuretted hydrogen, and silver sulphide is not reduced by hydrogen. Above 280°, both reactions occur, and attain the same limit of composition of the gaseous mixture for each temperature. The lower the temperature the more sulphuretted hydrogen is contained in the mixture of gases. The reactions which occur between 180° and 280° C. still require study.

—A. C. W.

Magnesium Phosphide. H. Gautier. Comptes Rend. 1899, **128**, [19], 1167—1169.

For the preparation of magnesium phosphide, two graphite boats are placed in a hard glass tube a little distance apart; one contains magnesium filings and the other well-dried red phosphorus. A current of hydrogen is passed through the tube from the phosphorus towards the magnesium, and the phosphorus is then distilled over the magnesium previously heated to redness. Combination readily takes place with incandescence, and when complete, the whole is cooled in a current of hydrogen gas. The tube is opened in a bell jar containing carbon dioxide in the form of snow. The phosphide is thus obtained in small brilliant crystals of a deep greenish-grey colour. It is very easily decomposed by water or moist air. It is analysed by placing in a distilling flask connected with bulbs containing silver nitrate solution, and conducting a stream of moist air through the apparatus. Phosphuretted hydrogen is evolved, and is absorbed by the silver nitrate, the resulting silver phosphide being oxidised by nitric acid, and estimated as phosphoric acid. Analysis gives results corresponding to the formula P_2Mg_3. Magnesium phosphide, when heated in dry oxygen, becomes incandescent and is oxidised to magnesium phosphate, but it is unaffected by dry air at the ordinary temperature. When heated in chlorine gas it burns with a bright light with formation of magnesium and phosphorus chlorides. Iodine and bromine act less powerfully, and only on heating. On treatment with hydrochloric acid, phosphuretted hydrogen is evolved; concentrated sulphuric acid slowly converts it into magnesium sulphate and phosphoric acid; whilst nitric acid has an analogous effect, the substance taking fire. It reacts easily with the metalloids of the first and second groups.—J. F. B.

Silicates, Action of Hydrogen Sulphide on. P. Didier. Comptes Rend. **128**, [21], 1286—1288.

The author passed hydrogen sulphide, at a temperature of about 1,400° C., over finely powdered and sifted silicates contained in porcelain or carbon boats in porcelain tubes. In certain cases the sulphides of the metals formed separate by volatilisation or crystallisation; but many of them remain mingled with the rest of the substance, and could only be attacked by such reagents as act upon the silicate itself. Sometimes, too, the sulphides formed could be detected by their colour, and could be separated by dilute acids which do not act on the rest of the substance. Details of the action of the gas on *peridote, cerite, jeffersonite, asbestos*, and *lepidomelane* are given, showing varying amounts of sulphur fixed, and of decomposition, after the reaction, by acetic or dilute hydrochloric acid. On many occasions the formation of small amounts of sulphuric acid was observed, and in other cases there was a blackening of the tube indicative of silicon. When silica itself was exposed to the action of the gas, a crystalline ring was deposited on the cooler parts of the tube, probably a mixture of silicon and one of its compounds.—J. T. D.

Graphitic Acid, Preparation of. L. Staudenmaier. Ber. **32**, [9], 1394—1399.

The author's process (this Journal, 1898, 880) can be used to demonstrate in lecture the formation of graphitic acid, as the reaction takes place very rapidly at a temperature of 80° C., and can be safely carried out at this temperature on a small scale. From 0·05 to 0·1 grm. of graphite, as finely divided as possible, is subjected to oxidation by sulphuric and nitric acids and potassium chlorate, on a water-bath, at 80° C., for less than an hour. A sample of the substance taken out and placed in strong nitric acid shows the intermediate green substance; the rest is then treated with permanganate and hydrogen peroxide, as described in the former memoir.

By working at the freezing point, and adding the potassium chlorate slowly, the author has converted as much as 250 grms. of graphite at one operation into graphitic acid without difficulty or danger of explosion. With care in stirring the liquid, so as to avoid local rise of temperature, large quantities can even be operated on safely at 20° C., at which temperature the oxidation proceeds some twenty times as rapidly as at the freezing point. If commercial graphite be used in this process, the impurities (quartz, mica, &c.) of course remain in the graphitic acid; but this will be of no importance in the future, for graphitic acid will only be prepared in quantity when soluble derivatives of it have been discovered.—J. T. D.

Phosphine [Phosphuretted Hydrogen], Action of, on Copper, Cuprous Oxide, and Ammoniacal Solutions of Cupric Salts. E. Rubénovitch. Comptes Rend. **128**, [23], 1398—1401.

The author has extended his former work (this Journal, 1898, 963) on copper sulphate to the metal itself, and others of its compounds. Phosphine, in the absence of air, does not act on precipitated copper at the ordinary temperature, but at 180°—200° C., the red metal becomes converted into grey phosphide, and hydrogen is set free—

$$PH_3 + 3Cu = PCu_3 + 1 \cdot 5H_2.$$

The phosphide slowly oxidises in oxygen at the ordinary temperature; at 100° C., it burns vividly, forming phosphoric anhydride. Precipitated cuprous oxide is acted on rapidly by phosphine at the ordinary temperature, forming a grey mass and water; the grey substance is quite insoluble in water, if air be excluded; it is the same phosphide as that above. It melts at a red heat, is readily dissolved by nitric acid or bromine water, and is attacked by hot sulphuric acid, with formation of sulphur dioxide and phosphine. It does not reduce potassium permanganate. While phosphine acts differently on the aqueous solutions of different cupric salts, its action on the ammoniacal solutions of all of them (chloride, sulphate, nitrate, acetate, formate, hydroxide) is the same. Copper phosphide is formed in amount corresponding to two-thirds of the phosphine which disappears, while the phosphorus of the the other third is found in the liquid, as phosphoric and hypophosphorous acids in molecular proportions—

$$6PH_3 + 12CuCl_2 + 6H_2O + xNH_3 =$$
$$4PCu_3 + PO_4H_3 + PO_2H_3 + 24HCl + xNH_3.$$

If, after the absorption of the phosphine, oxygen be admitted, the precipitate redissolves completely, using up a volume of oxygen double of that of the phosphine absorbed in the first place.—J. T. D.

Oxalic Acid Solutions, Catalytic Action of some Metals on. O. Sulc. Zeits. physik. Chem. **28**, 619—628; Chem. Centr. 1899, **1**, [22], 1150.

The author refers to the experiments of Jorissen (this Journal, 1899, 80) and points out that oxalic acid solutions are also decomposed in the dark in presence of palladium, platinum, or silver; palladium exerts the strongest action. In the light the decomposition is very considerably accelerated by the presence of the metals.—A. S.

Sugar Beet Investigations in 1898. New York Agric. Expt. Station Bulletin, 1898, [155], 347—373.

A large number of beet culture experiments were made in co-operation with the farmers in 10 different counties.

The fertiliser increased the yield of beets, but not the percentage of sugar nor the purity. The use of 500 lb. per acre decreased the cost of the beets 22 cents per ton; the application of larger quantities of fertiliser did not produce any further decrease in the cost of beets, 500 lb. per acre was the most economical quantity.

When 20 tons of stable manure per acre were applied instead of the artificial fertiliser, an increase of yield was found in every case, as compared with the unmanured plots, the average increase being 8,720 lb. per acre. The percentage of sugar was increased by an average of 1·5 per cent. and the purity coefficient was increased by 1·6; the size of the beets was diminished by 2¾ oz. on the average. The use of 20 tons of stable manure per acre furnishes very much more plant food than do 500 lb. of the commercial fertiliser, but it is not all available at once. In growing the beets at different distances apart in the rows, it was found that the nearer the beets were to each other, the smaller was the yield per acre, and the size of the roots was also less.—J. F. B.

Formaldehyde, Action of Hydrogen Peroxide on. A. Harden. Proc. Chem. Soc. **15**, [212], 158—159.

When solutions of hydrogen peroxide and formaldehyde are mixed, no reaction appears to take place, but when the liquid is made strongly alkaline with soda, hydrogen is evolved. The reaction occurs according to the equation $H_2O_2 + 2CH_2O + 2NaOH = 2H \cdot CO_2Na + H_2 + 2H_2O$. Hydrogen peroxide, therefore, when treated with alkaline formaldehyde, gives a volume of hydrogen exactly equal to the volume of oxygen which it would give with potassium permanganate and sulphuric acid.

The reaction proceeds slowly and incompletely unless a large excess of alkali be present. When hydrogen peroxide is treated with excess of formaldehyde, the reaction takes place rapidly and completely, and the hydrogen which is evolved is pure. When, on the other hand, formaldehyde is treated with excess of hydrogen peroxide, the reaction is incomplete and proceeds very slowly, whilst the gas evolved contains oxygen. Hence the reaction does not appear adapted for the quantitative estimation of formaldehyde in aqueous solutions.

Cuprous oxide and soda give a somewhat similar reaction, with formaldehyde. This reaction was described by Loew (Ber. 1887, **20**, 145) as a catalytic reaction, but it appears in reality to be a quantitative one, expressed by the equation $Cu_2O + 2NaOH + 2CH_2O = Cu_2 + H_2 + 2H.CO_2Na + H_2O$. Cupric oxide also gives a similar reaction, two atoms of hydrogen being liberated for each atom of oxygen in the oxide.

When caustic soda and then formaldehyde are added to a solution of copper sulphate and the liquid gently warmed, the cupric hydroxide is reduced to cuprous oxide without evolution of hydrogen, and when the temperature is subsequently raised, the cuprous oxide reacts as described above. When, on the other hand, caustic soda is added to a boiling solution of copper sulphate, the liquid cooled, and formaldehyde then added, no reduction to cuprous oxide occurs on warming, but metallic copper is formed, and twice as much hydrogen is evolved as in the previous case.

Manganese dioxide does not appear to be reduced by formaldehyde, whilst the oxides of mercury and bismuth are reduced without evolution of hydrogen.

New Books.

A Short History of the Progress of Scientific Chemistry in our own Times. By William A. Tilden, D.Sc., F.R.S., &c. Longmans, Green, and Co., 39, Paternoster Row, London, E.C.; also New York and Bombay. 1899. Price 5*s*.

Small 8vo volume, containing preface, table of contents, and subject-matter filling 266 pages. There follows then a tabulated arrangement of "Important Events arranged in Chronological Order," one of which is recorded as "Society of Chemical Industry founded . . . . 1881." Finally, an alphabetical index of subjects. In Chapter IV., under "Numerical Relations among the Atomic Weights: Classification of the Elements," full credit is accorded to John A. R. Newlands both as discoverer and prophet in connection with the periodic relations of the atomic weights of the elements, and the following sentence occurs:—

"The Chemical Society in 1866 were disposed to laugh at Newlands and his 'law.' Twenty-one years later the Royal Society awarded him the Davy Medal for his discovery." The text is classified as follows:—I. Matter and Energy. II. The Chemical Elements: Their Distribution in Nature and Recognition by the Chemist. III. Rectification and Standardisation of Atomic Weights. IV. Numerical Relations among the Atomic Weights, &c. V. Origin and Development of the Ideas of Valency and the linking of the Atoms. VI. Development of Synthetical Chemistry. VII. Origin of Stereo-Chemistry. Constitutional Formulæ in Space. VIII. Electricity and Chemical Affinity. IX. Discoveries relating to the Liquefaction of Gases.

Chemische Technologie der Azofarbstoffe, mit besonderer Berücksichtigung der deutschen Patent Literatur. Von Dr. Carl Bülow. I. Theil: Natürliche Systematik der Azofarbstoffe. II. Theil: Fabrikation und Anwendung der Azofarbstoffe, Uebersichtlich Geordnet auf Grund der "Natürlichen Systematik der Azofarbstoffe." Otto Wigand's Verlag, Leipzig, Germany. H. Grevel and Co., 33, King Street, Covent Garden, London. 1897 and 1898. Prices: I. Theil, 4*s*.; II. Theil, 18*s*.

This work appears in two volumes or parts. Part I. forms an 8vo volume containing introduction and subject-matter filling 123 pages.

Part II. forms an 8vo volume similar in size and style to Part I. It contains a preface, table of errata, and 698 pages of subject-matter, followed by alphabetical indexes of authors and patentees, and of subject-matter. The classification of the text is on the following lines:—I. Chief Class: Monoazo Dyestuffs. i. Group: Simple Mono-azodyestuffs. ii. Subsidiary Group: Primary Azo Dyestuffs. II. Class: Primary Disazo Dyestuffs. III. Class: Secondary Disazo-Dyestuffs. II. Chief Class: Disazo-Dyestuffs. IV. Class: Ordinary Disazo Dyestuffs. V. Class: Disazo Dyestuffs. i. Subsidiary Group: Primary Symmetric Disazo-azo Dyestuffs. III. Chief Class: Trisazo dyestuffs. VI. Class: Ordinary Trisazo Dyestuffs.

On pages 668—681, there is given in the form also of a table of contents, a classified arrangement of the azo dyestuffs, and on pages 682—692, a list or index of patents taken out in Germany. Following this are tables giving separately the patents taken out in Germany, America, England, and France.

Patents, Designs, and Trade Marks. Sixteenth Report of the Comptroller-General of Patents, Designs, and Trade Marks, with appendices, for the year 1898. (202.) Price 3*d*.

It is stated in the report that the applications for patents in 1898 numbered 27,659, as against 30,952 in 1897, a decrease of 3,293, or 10·7 per cent. This falling-off was chiefly in applications accompanied by provisional specifications, which decreased by 3,060, or 12 per cent., while those accompanied by complete specifications decreased by only 233, or 4·2 per cent.

There was also a decrease of 735 or 7·6 per cent. in the number of the complete specifications filed after provisional specifications. Thus the decrease in the total number of specifications received was 4,028, or 9·9 per cent. It is noticeable that while fewer provisional specifications were received than in either 1897 or 1896, the number of complete specifications, though less than in 1897, was larger than in 1896.

Prizes.

The Sulphate of Ammonia Prize Essay.

Chem. Trade J., July 15, 1899, 35.

The prize of 500 guineas offered by the Sulphate of Ammonia Committee for the best essay on "The Utility of Sulphate of Ammonia in Agriculture," has been awarded to Mr. James Muir, M.R.A.C., formerly Professor at the Royal Agricultural College, Cirencester, subsequently at the Yorkshire College, Leeds, and at present Instructor in Agriculture to the Somerset County Council. There were 73 essays sent in. The judges were Mr. J. Bowen-Jones, of Shrewsbury, and Dr. J. A. Voelcker, of London.

Trade Report.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

Trade of Portland, Oregon.

Foreign Office Annual Series, No. 2295, *June* 1899.

Imports.

The Japanese trade is of the highest value, consisting principally of raw and waste silk, 98,189*l*.; tea, 10,727*l*.; rice, 8,223*l*.; matting, 4,110*l*.; and sulphur, 10,118*l*., the latter being extensively used by the paper and pulp makers.

Amongst European countries Great Britain takes first place, showing an increase, the principal articles being earthenware, 9,360*l*.; salt, 3,483*l*.; cement, 1,035*l*.; firebricks, 596*l*.; cutlery, 275*l*.; malt liquors, 2,926*l*.; spirits, 334*l*.

Belgium is next with cement, 5,800*l*.; window-glass, 4,077*l*.; spices, 205*l*.; spirits, 1,725*l*.; earthenware, 91*l*.

From Italy was received a cargo of sulphur valued at 7,857*l*.

Direct imports from Germany show a decrease of over one-third, due to there having been no German cement received. Principal articles were earthenware, 1,811*l*.; glass, 156*l*.; cutlery, 324*l*.

Of the cement imported only 15 per cent. was British, the rest being Belgian. It is stated that the Belgian and German makers are so full of orders that more British is likely to be imported in 1899, especially as some of the British makers have at last begun to grind as fine as their Continental competitors.

The trade was satisfactory, prices averaging 12*s*. per cask.

In caustic soda and soda ash there is now a strong competition with American, and the trade is falling off. For firebricks there has been a good demand, with a tendency to increase.

Exports.

There are many mills in this State which manufacture paper-pulp from straw, cottonwood, spruce, and white fir.

couraged, it has ousted the British article from the Persian market.

First-class drugs of British origin are much sought after and their cost willingly paid.

MINERAL RETURNS OF NEW CALEDONIA FOR 1898.

Foreign Office Annual Series, No. 2300, *June* 1899.

In consequence of better markets in Europe, the value of the mineral export has increased this year by over 14,000*l*.

Nickel still stands to the front with an export of 69,800 tons, against 33,700 tons in 1897.

Chrome comes next in importance. Large orders are in hand for this mineral, which is mostly found in the south of the island, close to the sea beach.

Cobalt ore is about the same in demand as last year.

The great copper company ("International Mining Corporation") are erecting extensive plants for extracting the ore for shipment, which begins in January 1899.

Little has been doing in regard to silver lead owing to the difficulty experienced in separating the zinc from the lead.

"La Société de Nickel" are about to erect their smelting works at their mines at Tehio, on the east coast, for the treatment of their nickel ores.

The International Copper Corporation have decided to carry out their smelting operations in Australia.

PHOSPHATES IN ALGERIA.

Foreign Office Annual Series, No. 2302, *July* 1899.

The exploitation of phosphates only really dates back to 1893, when Madame Veuve Laporte sold her rights to Messrs. Crookston Brothers. Since that date the amount of phosphates exported was—

Year.	Quantity.
	Tons.
1893	5,118
1894	47,957
1895	113,044
1896	143,098
1897	220,617

And for the first 10 months of 1898, 206,000 tons, against 174,439 tons during the same period in 1897.

An export duty on phosphates has been established since October 1895, of 50 c. per ton extracted and not used in Algeria. This duty yielded in—

Year.	Amount.
	Francs.
1895	9,631
1896	71,549
1897	110,308
1898 (first 10 months)	102,988

This yield must increase, notwithstanding the competition which the Algerian phosphates will have to cope with when the American mines recommence working, which were lulled during the Spanish-American war, and when the Tunisian phosphates appear in the market.

WOOD-PULP AND CELLULOSE IN NORWAY IN 1898.

Foreign Office Annual Series, No. 2299, *June* 1899.

On the whole the year cannot be considered a favourable one for the producers of wood-pulp. Notwithstanding that the exportation from Norway was heavier in 1898 than in any preceding year, amounting to 22,877 tons dry and 246,338 tons wet, compared with 24,743 tons of the former and 230,575 tons of the latter in 1897, the increasing competition from Canada, who has shown herself a more powerful rival to Scandinavia than she has ever done hitherto, diminished the demand for the Norwegian article, and forced prices down. In consequence, millowners in Norway failed to reap the earnings they anticipated at the beginning of the year.

The attention of the Sandinavian Wood-pulp and Cellulose Association having been directed to the increasing competition from Canada, two experts were sent out—one mercantile and one technical—last autumn, to study the state of affairs. They appear to have reported that in their opinion the Canadian competition had for the present reached its maximum, and questioned whether the prices obtained were very profitable.

The pulp has been sent to the same markets as in former years. Great Britain is the principal consumer, though, owing to the supplies from Canada, she did not consume quite so much of the Norwegian article as in the year before. For the rest France, Spain, Belgium, and Denmark were good purchasers, while comparatively little went to Germany. Those manufacturers who had made contracts in advance made the best profits; but this branch of industry generally paid considerably less than in 1897. The quantity exported from Christiania was 38,883 tons, being 2,363 tons more than in 1897.

The number of wood-pulp mills is now 64, three of which are connected with cardboard factories, and 10 with paper mills.

The export trade in cellulose is of great importance to the city of Christiania, from which is drawn the greater part of the capital employed in its production, which is costly. Better profits were earned in this article than in wood-pulp, though, as in the case of the latter, the year was not such a satisfactory one for manufacturers as 1897 owing to the downward tendency of prices for the manufactured article, and the increased cost of the necessary raw materials. The quantity exported from Norway during the year amounted to 71,050 tons dry and 8,420 tons wet, being 3,391 tons less of the former and 2,914 tons more of the latter than in the year before. The bulk, as usual, went to Great Britain; the rest to France, Holland, and other countries. In this article, as in wood-pulp, Canadian competition has militated against Scandinavian cellulose manufacturers; and the rise in the price of coal was also another item against them.

The experts, sent out in connection with the manufacture of wood-pulp in Canada, included cellulose in their investigations, and arrived at conclusions favourable to the Scandinavian industry, at least for the present.

No new factories were started during the year, but others have been enlarged, and the total production was several thousand tons more than in 1897, and it is estimated that this increase will be further considerably augmented in 1899. A new sulphite factory, calculated to produce on a large scale, is expected shortly to commence working.

ELECTRIC INDUSTRIES AT SARPSBORG, NORWAY.

Foreign Office Annual Series, No. 2299, *June* 1899.

Sarpsborg has during the last few years been making rapid strides towards becoming a busy manufacturing town. The many new factories in course of erection in the neighbourhood of the waterfall have entailed a large influx of workmen, who readily obtained employment at very good wages. The two large electric power stations, which are being erected by the Kellner Partington Paper Pulp Company, Limited, on one side of the river, and the Hafslund Aktieselskab on the other side, are now reaching completion, and are expected to be in full working order in the course of next summer.

The Aktieselskabet Hafslund, which, when ready, will have 23,000 horse-power at their disposal, have made arrangements with the municipal authorities in Fredrikstad to take over the entire lighting of the town, and also supply the necessary electric motive power that may be required. Consequently the expensive electric machinery erected in Fredrikstad a few years ago will now be taken down and sold, and the electric power will instead be brought down from Sarpsborg by overhead wires. The same company are also erecting a calcium carbide factory, which is calculated to produce 5,000 tons of calcium carbide annually. A similar factory, Atkieselskabet Carbide Industri, with an estimated annual production of 3,000 tons, is also nearing completion.

SULPHATE OF COPPER IN FRANCE.

Chem. and Druggist, July 1, 1899, 38.

Mr. J. C. Covert, United States Consul at Lyons, has reported to his Government upon the consumption of sulphate of copper in France. Sulphate of copper is required by the vine-growers of France, who, since the introduction of Bordeaux mixture about a dozen years ago, have used large quantities of it for keeping down black-rot and mildew in vines. In 1895 France imported 24,641 tons of the sulphate, in 1896, 34,539 tons; in 1897, 30,909 tons; and in 1898, 31,468 tons. The Consul also mentions the recent Commission appointed by the Chamber of Deputies to consider the advance in the price of the sulphate, consequent upon the enhanced cost of the metal. The Commission reported adversely against the proposal to reduce the Customs duty, which now yields 90,000 frs. annually to the revenue.

BRAZILIAN PHOSPHATES.

Foreign Office Annual Series, No. 2288, *June* 1899.

The Island of Fernando da Noronha is situated some 300 miles to the north-east of Pernambuco, and a concession has been granted to two native gentlemen to explore the deposits of phosphate of lime found on the small islands of this archipelago. It is estimated that from 500,000 to 600,000 tons of phosphate could be extracted from the islet named Rata; of this 200,000 tons are estimated to be of 80 to 86 per cent. of approximately pure phosphate, containing, however, about 1½ per cent. of aluminium and iron. The remainder (300,000 to 400,000 tons) is less rich, varying between 45 and 60 per cent. of phosphate, and containing from 2 to 4 per cent. of aluminium and iron.

The island of Fernando da Noronha is a penal settlement having 229 convicts in 1898.

In the concession given for the exploration of phosphate of lime the concessionnaires have obtained permission to employ 50 convicts as labourers at the wages of 860 reis per day and their food. This would mean cheap labour, and should the better phosphate be worth 2*l.* to 2*l.* 10*s.* per ton, a considerable profit is likely to be made from its export.

GERMAN BEET-SUGAR.

Chem. and Druggist, June 24, 1899, 1001.

A return prepared by the U.S.A. Bureau of Foreign Commerce shows that since 1877 the German beet-sugar industry has increased from a total production of 383,823 tons per annum to 1,725,000 tons in 1898–99; but the sugar refineries have decreased from 64 to 54 in the same period. The percentage of sugar in the beet has been increased from 9·24 to 13·15. The exports show the most startling figures, for although only 71,201 tons of raw sugar were exported in 1877–78, no less than 1,229,592 tons were sent out in 1896–97; but last year there was a falling-off. Great Britain took 666,263 tons last year—*i.e.*, six-tenths of the whole exports. Germany imported 513 tons of raw and 707 tons of refined sugar in the same year, the total home consumption for the year being 803,897 tons, or 28·8 lb. per head of the population. The sugar-tax paid per head amounts to a little over 1*s.* 10*d.* a year, so that each pound of sugar used by the Germans costs them 1*d.* in tax, not allowing for the profit on the tax which sellers must take in the ordinary way of business. The bounty system has built the sugar industry of Germany, but it is now on the decline. The highest bounty paid was in 1884–85, when over 6,000,000*l.* was paid to manufacturers. It decreased steadily until 1891–92, when about 3,800,000*l.* was paid; in the year following the sum fell below two millions; in 1893–94 to half a million, and since then it has increased gradually to about 2,000,000*l.* Meanwhile, the taxes and duties yield as much as ever, but the money goes into the National Exchequer. The average price of refined sugar in Germany is a little over 2½*d.* per lb. We get the same for about 1½*d.*

INLAND REVENUE REGULATION FOR MIXING METHYLATED SPIRIT.

June 1899.

1st. All wood naphtha submitted for approval as suitable for methylating purposes shall consist of substances derived from the destructive distillation of wood, and shall not contain any substance or mixture obtained from any other course.

2nd. The wood naphtha must be sufficiently impure to impart to the methylated spirits, prepared by mixing one part with nine parts of spirits of wine, such an amount of nauseousness as will, in the opinion of the principal of the government laboratory, render such spirit incapable of being used as a beverage, or of being mixed with potable spirits of any kind without rendering them unfit for human consumption.

Wood naphtha submitted for approval should conform to the following tests:—

(*a.*) Not more than 30 c.c. of the naphtha should be required to decolorise a solution containing 0·5 grm. of bromine.

(*b.*) The naphtha, which must be neutral or only slightly alkaline to litmus, should require at least 5 c.c. of deci-normal acid to neutralise 25 c.c. of the spirit when methyl orange is used as the indicator.

3rd. No wood naphtha will be approved which contains:—

(*a.*) Less than 72 per cent. by volume of methyl alcohol.

(*b.*) More than 12 grms. per 100 c.c. of acetone, aldehydes, and higher ketones, estimated as "acetone" by the formation of iodoform according to Messinger's method.

(*c.*) More than 3 grms. per 100 c.c. of esters, estimated as methyl acetate by hydrolysis.

Wood naphthas which, when fractionally distilled in the following manner, give the indications stated below will, as a rule, be found to contain a sufficient proportion of methyl alcohol, and to be free from an excess of "acetone" or methyl acetate.

100 c.c. of the sample are to be slowly heated in a small copper flask fitted with a glass fractionating column, 7 inches high and ¾ inch in diameter, filled to the extent of 4 inches of its height with small glass beads, provided with a thermometer placed opposite the exit tube about an inch above the beads, and connected with a spiral condenser. Not more than 10 c.c. of distillate should be collected in the receiver when the thermometer in the fractionating column marks a temperature of just under 149° F. (65° C.); from 80 c.c. to 85 c.c. should pass over between 149° F. (65° C.) and 162° F. (72·2° C.); and a total quantity of 97 c.c. to 98 c.c. should have passed over before the thermometer marks 212° F. (100° C.)

CALCIUM CARBIDE FACTORIES IN NORWAY.

Bd. of Trade J., July 1899, 82.

A despatch, dated 8th June last, has been received at the Foreign Office from H.M. Consul-General at Christiania, reporting that two calcium carbide factories have started work in Norway. The larger, of 3,000 horse-power, is situated near Hafslund, the smaller, of 1,500 horse-power, near Borregaard, facing each other on either side of the Sarpfoss waterfall, above Fredrikstad. It is stated that the Hafslund Factory is shortly to be increased to 5,000 horse-power. It has been built by the Elecktricitätz Aktiengesellschaft (formerly Schuckert and Co.), Nürnberg.

It was expected that in July or August 1899, a third factory in Meraker, of 1,500 horse-power, was to be opened, and next year one in Kinservik, of 3,600 horse-power. About twenty to thirty other calcium carbide factories are in contemplation.

With its many waterfalls and a plentiful supply of chalk-stone in some localities, Norway would appear to be more favourably situated, with regard to the production of calcium carbide, than countries where steam (and not water) has to be used to produce the necessary electric power. It is estimated that the cost of electric horse power, produced by waterfalls, will be about 16 to 20 kroner (17*s.* 9*d.* to 1*l.* 2*s.* 3*d.*) per horse-power per annum. If steam be used to generate electricity the cost is far greater. The cheapest rate quoted, for instance, by the Christiania Electric Works for a ten kilowatt motor of 3,000 working hours a year, is 200 kroner (11*l.* 2*s.* 3*d.*) per kilowatt per annum, or about 8*l.* 3*s.* 7*d.* per electric-horse power. On the other hand, if power be generated by water, the kilns can burn all Sunday—a matter of some importance in the manufacture of calcium carbide—without extra cost.

Norway, as is well known, does not produce coal. It is suggested, however, that charcoal might be used instead; but in that case the percentage of ash should not exceed 7 per cent. But it is of more consequence to possess cheap power and chalk together, rather than cheap power and coal in the same locality, and that as cheap power is such an important factor, no other country, however rich in chalk and coal, can compete with Norway, unless equally well supplied with waterfalls. The amount of burnt chalk and coal required to produce a ton of calcium carbide is estimated at 1·2 ton of chalk and 0·8 ton of cinders.

Discoveries of Coal in North Eastern France.

Bd. of Trade J., July 1899, 85.

A despatch, dated 9th June last, has been received at the Foreign Office from H.M. Consul at Calais concerning recent discoveries of coal in the Pas-de-Calais, at Frèmicourt, which, though not very far from existing workings, is looked upon by geologists as important, as being below an imaginary line to the south of which coal was not supposed to exist, a "fault" or rock-wall intervening. It is now thought that further seams of coal may be found to the south of the said line. The seam first struck is said to be about two and a half feet thick, of good bituminous coal, and another seam has been found only ten feet lower down.

It is stated that the coal is identical with that found at the Kentish borings between Dover and Canterbury, the progress of which had been watched with great interest by M. Breton, the engineer whose name is associated with the recent discovies in the Pas-de-Calais.

Adulteration of Flour in Maine.

Foreign Office Annual Series, No. 2314, *July* 1899.

The Secretary of the State Board of Agriculture during the past year issued a circular notice for the information of the public, cautioning them against an adulteration termed "mineraline," which the manufacturers claimed was being extensively used in high and medium-grade flour, also in bread and feed-meal. Chemical analysis proved "mineraline" to be ground soapstone. The manufacturers in urging its adoption and sale, claimed that when mixed with flour the latter became whiter, &c., and by this adulteration an increased profit to the retailer was assured.

Sulphur Refining in Sicily.

Chem. and Druggist, July 6, 1899, 134.

The United States Consuls at Catania and Palermo, reporting on sulphur refining in Sicily, state that there are four systems employed in Catania, *viz.*, the "calcarone," Gill, Fiocchi, and Orlando. The first, the calcarone or kiln, is the primitive method of extraction, and is the one generally used. The "Gill" is a more modern system, and consists of furnaces or batteries worked in a series of four. The following is the account of the process:—

After being charged the ore in one cell is fired, and the smoke, instead of passing into the open air, as is the case with the calcarone, passes into the adjacent cell and gradually heats the mineral, until by the time the first cell has finished working, the other has reached such a temperature that the ore ignites and cell No. 1 is again filled; and so the process goes on. The advantage is that the gases, which are heavily charged with sulphur, are not lost, and the percentage of sulphur recovered is considerably high; further, the time occupied is much less than with the calcarone, the working of each cell occupying from seventy-two to ninety-six hours, according to size; and as very little smoke escapes, the proprietors can work all through the year. Catania is the head-quarters of the sulphur-refining industry, with the exception of one plant at Palermo. The largest plant consists of four ovens, each containing a battery of ten retorts for refining, capable of turning out 48 tons of refined sulphur in 24 hours; four ovens with four chambers for subliming and making flower of sulphur, capable of producing 2,000 tons during a season; and a steam mill with runner edge stones of lava, capable of milling 3,000 half-cwt. bags (165,000 lb.) of sulphur per day. The refining season commences in October and ends in June, while the milling season lasts only about four months—February to June. In Palermo reduction by the calcarone is the more general method in use, as the furnace is of easy construction and inexpensive, being operated in the open air. The quantity of sulphur produced by this system during 1890, 1891, 1892, 1893, and 1894, as respects the total production of the mines operated, shows the following proportions: 80 per cent., 71 per cent., 65 per cent., 66 per cent., and 62 per cent. respectively.

Food Preservatives.

Chem. and Druggist, July 15, 1899, 81.

The President of the Local Government Board has appointed a departmental committee to inquire into the use of preservatives and colouring matters in the preservation and colouring of food, and to report (1) whether the use of such materials, or any of them, for the preservation and colouring of food, in certain quantities, is injurious to health, and, if so, in what proportion does their use become injurious; (2) to what extent and in what amounts are they so used at the present time. The committee consists of the Right Hon. Sir H. E. Maxwell, M.P.; Prof. Thorpe, V.P.R.S.; Dr. Bulstrode; and Dr. Tunnicliffe. Sir H. Maxwell has been appointed chairman of the committee, and Mr. C. J. Huddart, of the Local Government Board, will act as secretary.

GENERAL TRADE NOTES.

Briquettes of Bituminous Coal.

Bd. of Trade J., July 1899, 98.

According to the Baltimore *American*, the soft-coal dealers of that region are much interested in a proposition from Chicago to utilise coal-dust at the mines in the manufacture of bricks for heating purposes. The company which intends to utilise the dust of both bituminous and anthracite coal is known as the Briquette Coal Company. A factory plant has been established in Chicago. The inventor claims that bricks manufactured by his process will yield more heat than either bituminous or anthracite coal in its original form. It is estimated by mine-owners that at least 1,000,000 tons of coal-dust are wasted annually, though much is used in filling up swampy land and as beds for railroad tracks. It has been a nuisance from its liability, if allowed to accumulate, to choke up the shafts to mines.

So far as the process of the inventor has been explained, the dust is thrown into a big receptacle, and is carried thence to a boiler, and heated almost to the ignition temperature of the dust. The paste or pitch is then added, and the combination is next passed to a press, where the brick is moulded. The apparatus for producing the brick is automatic. It is claimed that in the process of manufacture of the brick the undesirable gases and elements in coal are dissipated.

New Insulating Material.

Bd. of Trade J., July 1899, 98.

A new insulating material known as iron felt is made at the Aldershof Works, near Berlin. This felt, according to the *Manufacturer*, consists essentially of long and strong woollen fibres, impregnated with a by-product of petroleum, and then coated (with a certain amount of penetration) by a gelatine rendered insoluble, and also (alternatively or in addition) with india-rubber, afterwards vulcanised. After being subjected to considerable pressure, the iron felt assumes the form of plates, measuring 20 square centimetres and upwards, with a thickness varying from 1 to 5 centimetres. These plates are very elastic, being practically imperishable, while they will stand a pressure of 1,158 kilos. per square centimetre (20,736 pounds per square inch), and their surface is so hard as not to be cut by the sharp edges of bolt heads or of iron girders. Placed as a cushion between rails and their chair, or sleepers, under plummer-blocks, or between engines and their foundations, this material, it is claimed, will prevent vibration.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 30th June.	
	1898.	1899.
	£	£
Metals	1,994,529	2,139,977
Chemicals and dyestuffs	479,388	430,561
Oils	735,273	869,062
Raw materials for non-textile industries.	4,487,625	5,106,174
Total value of all imports	39,032,305	38,348,943

SUMMARY OF EXPORTS.

Articles.	Month ending 30th June.	
	1898.	1899.
	£	£
Metals (other than machinery)	2,820,557	3,361,824
Chemicals and medicines	678,061	772,680
Miscellaneous articles	2,801,203	3,055,366
Total value of all exports	19,413,696	21,980,067

IMPORTS OF METALS FOR MONTH ENDING 30TH JUNE.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Copper :—					
Ore	Tons	5,788	8,189	38,732	67,907
Regulus	"	6,696	6,071	183,741	183,904
Unwrought	"	7,078	3,951	369,634	295,858
Iron :—					
Pig	"	8,904	17,257	37,835	67,832
Ore	"	484,261	578,569	360,371	437,477
Bolt, bar, &c.	"	9,006	8,197	72,968	67,428
Steel, unwrought	"	3,703	4,447	22,558	29,827
Lead, pig and sheet	"	15,581	12,540	209,699	176,392
Pyrites	"	51,141	69,783	80,852	121,284
Quicksilver	Lb.	931,500	837,125	91,390	89,962
Silver ore	Value £	..	..	99,849	56,803
Tin	Cwt.	30,937	27,072	102,237	156,373
Zinc	Tons	6,524	5,986	111,457	152,227
Other articles	Value £	..	..	..	..
Total value		..	..	1,994,529	2,139,977

IMPORTS OF OILS FOR MONTH ENDING 30TH JUNE.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Cocoa-nut	Cwt.	24,751	42,574	27,870	52,162
Olive	Tuns	2,550	1,096	84,059	38,545
Palm	Cwt.	97,355	98,105	103,414	105,492
Petroleum	Gall.	15,943,236	22,234,582	266,005	397,331
Seed	Tons	2,552	4,782	50,261	86,096
Train, &c.	Tuns	2,244	918	41,457	16,498
Turpentine	Cwt.	67,159	58,957	73,181	93,682
Other articles	Value £	..	..	89,016	79,256
Total value		..	..	735,273	869,062

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH ENDING 30TH JUNE.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Alkali	Cwt.	29,657	22,165	16,454	13,125
Bark (Tanners', &c.)	"	57,453	34,834	16,482	15,318
Borax	"	34	58	22	86
Brimstone	"	54,010	44,283	11,746	10,250
Chemicals	Value £	..	..	132,694	112,344
Cochineal	Cwt.	673	84	3,931	492
Cutch and gambier	Tons	1,584	1,186	27,804	19,582
Dyes :—					
Alizarin	Value £	..	..	20,087	19,760
Anilin and other	"	..	..	39,157	35,049
Indigo	Cwt.	1,844	1,791	29,551	28,081
Nitrate of potash	"	23,727	22,490	17,909	18,902
Valonia	Tons	2,862	1,404	31,422	16,874
Other articles	Value £	..	..	132,129	140,678
Total value		..	..	479,388	430,561

IMPORTS OF RAW MATERIAL FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 30TH JUNE.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Bark, Peruvian	Cwt.	4,054	2,893	7,834	6,476
Bristles	Lb.	369,160	213,614	44,544	25,655
Caoutchouc	Cwt.	36,290	33,758	423,032	440,253
Gum :—					
Arabic	"	5,693	4,032	13,230	9,655
Lac, &c.	"	12,085	7,545	40,987	25,081
Gutta-percha	"	6,885	6,399	72,325	74,055
Hides, raw :—					
Dry	"	35,517	33,642	101,222	87,978
Wet	"	62,820	65,447	133,483	142,334
Ivory	"	1,126	894	45,860	38,647
Manure :—					
Guano	Tons	140	2,304	476	10,984
Bones	"	1,714	2,105	6,885	9,712
Nitrate of soda	"	5,700	7,054	42,452	51,108
Phosphate of lime	"	24,964	35,087	37,489	52,271
Paraffin	Cwt.	56,470	91,157	50,394	82,536
Linen rags	Tons	2,292	2,315	20,279	18,190
Esparto	"	15,512	20,074	57,501	76,984
Pulp of wood :—					
Chemical	"	16,421	20,312	116,958	146,847
Mechanical	"	15,334	24,918	43,363	59,678
Rosin	Cwt.	181,232	155,291	41,563	36,483
Tallow and stearin	"	228,493	190,385	236,485	213,124
Tar	Barrels	2,165	9,618	1,228	6,492
Wood :—					
Hewn	Loads	190,764	239,823	441,824	495,749
Sawn	"	636,491	830,572	1,539,471	1,970,425
Staves	"	12,743	10,645	49,046	56,130
Mahogany	Tons	4,541	3,268	41,879	32,485
Other articles	Value £	..	..	878,075	936,842
Total value		..	..	4,487,625	5,106,174

Besides the above, drugs to the value of 105,591*l*. were imported, as against 74,412*l*. in June 1898.

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 30TH JUNE.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Alkali	Cwt.	278,797	314,645	75,478	89,082
Bleaching materials	"	109,045	112,607	29,513	28,364
Chemical manures	Tons	31,965	33,545	165,191	206,640
Copper sulphate	"	4,124	3,527	66,045	82,611
Medicines	Value £	..	..	97,739	104,235
Other articles	"	..	..	244,095	261,718
Total value		..	..	678,061	772,680

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Brass............ Cwt.	7,947	13,209	36,646	58,923
Copper:—				
Unwrought.... „	45,916	55,777	124,146	215,062
Wrought...... „	19,355	16,923	60,874	73,235
Mixed metal... „	15,485	14,377	38,400	47,319
Cutlery..........Value £ } Hardware........ „ }	..	..	167,626	169,932
Implements...... „	..	..	114,695	119,923
Iron and Steel ... Tons	275,034	324,944	1,898,265	2,387,085
Lead............. „	3,494	4,674	50,989	72,720
Plated wares... Value £	..	..	32,889	31,721
Telegraph wires.. „	..	..	145,281	27,817
Tin............... Cwt.	11,999	9,310	41,128	55,610
Zinc.............. „	16,524	9,434	14,365	10,622
Other articles...Value £	..	..	94,953	92,055
Total value.......	..	..	2,820,557	3,361,824

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH ENDING 30TH JUNE.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Gunpowder. ... Lb.	595,000	540,000	16,879	13,604
Military stores.. Value £	..	..	158,317	163,212
Candles.......... Lb.	1,820,700	2,686,600	25,719	40,457
Caoutchouc..... Value £	..	..	105,293	112,534
Cement.......... Tons	31,996	34,478	60,511	67,473
Products of coal. Value £	..	..	134,369	125,561
Earthenware ... „	..	..	150,958	169,256
Stoneware ...... „	..	..	12,129	18,226
Glass:—				
Plate.......... Sq. Ft.	123,791	166,481	7,286	9,112
Flint.......... Cwt.	7,099	7,131	16,355	17,799
Bottles........ „	68,077	72,664	33,121	35,076
Other kinds ... „	18,461	23,119	16,580	21,731
Leather:—				
Unwrought.... „	15,958	12,988	137,407	123,614
Wrought......Value £	..	..	30,801	27,854
Seed oil......... Tons	3,289	3,131	58,267	61,529
Floorcloth.......Sq. Yds.	1,826,600	2,273,600	78,972	100,281
Painters' materials Val. £	..	..	151,535	150,658
Paper............. Cwt.	83,522	75 877	122,488	118,700
Rags............. Tons	5,081	5,735	25,825	31,478
Soap.............. Cwt.	83,068	88,007	87,476	86,807
Total value.........	..	..	2,801,203	3,055,366

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

12,761. C. D. Abel.—From A. B. Helbig and Portland Cement Fabrik Hemmore, Germany. Improvements in automatic charging apparatus. June 19.

12,841. L. O. Boeing. An improved filling for evaporating, concentrating, and condensing towers and similar apparatus. Complete Specification. June 20.

12,921. C. S. Snell and F. A. Snell. Improvements in apparatus for compressing gas, air, or the like. June 21.

13,128. W. H. Barr. Improvements in apparatus for the filtration and purification of water, spirits, beer, steam, and other fluids. June 24.

13,225. J. Fischer. Improved method of distillation or condensation and apparatus therefor. June 26.

13,317. T. Howard and Co., Ltd., and J. E. Howard. Improvements in air and gas compressors. June 27.

13,736. C. D. Abel. — From Gesellschaft fur Huber Pressung C. Huber and Co., Germany. Improved construction of chambers or cylinders for containing fluid under pressure and apparatus for producing the pressure therein. July 3.

13,834. W. P. Thompson. — From W. B. Devereux, United States. Improvements in calcining furnaces. Complete Specification. July 4.

13,875. E. Edwards. — From H. Geppert, Germany. Improvements in diffusion-absorption refrigerating apparatus. July 5.

13,912. J. Gommesen. Improvements in centrifugal apparatus for the separation of fats or grease from liquors containing same. July 5.

14,086. C. S. Snell. Improvements in apparatus for compressing gas, air, or the like. July 8.

14,134. R. Fiedler, of the firm of Transportabler Dampfentwickler Gesellschaft. An improved process for reducing suitable substances into vapours, and apparatus therefor. Complete Specification. July 8.

14,199. A. Waché and E. Locoge. An improved mode of and apparatus for effecting the flow of liquids with the object of heating or cooling the same or absorbing gases into flowing liquids. July 10.

14,319. J. Raschen, J. S. Conroy, and The United Alkali Company, Ltd. Improvements in distilling apparatus. July 11.

14,323. D. Rojat. Improved apparatus for pasteurising and heating and cooling liquids. July 11.

14,600. C. E. McAllister, R. McAllister, and W. T. Harris. Preventing and removing incrustation of boilers. July 15.

14,643. G. G. M. Hardingham. — From A. Musciacco, Italy. Improved means applicable for use in proportioning and mixing finely divided or powdered substances. July 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1898.

14,228. W. Hinchcliffe. Apparatus for drying, purifying, separating oil or grease from and condensing steam, and for heating and purifying water for boiler feed and for other manufacturing purposes. July 5.

15,151. M. Otto. *See* Class XVII.

15,152. M. Otto. Apparatus for the preparation of sterilised ice in blocks or in bottles, and the sterilisation in a cold condition and at the ordinary pressure of liquids generally. July 12.

15,651. R. G. Nash. Means applicable for use in the sterilisation of liquids or substances. July 12.

18,074. J. Wilson. Filter presses and similar filtering apparatus. June 28.

18,345. A. Niel, *née* Janiot. Apparatus for regulating the flow and pressure of gas. June 28.

21,274. A. Dervaux. Process of and means for cleansing filtering material. July 5.

1899.

2673. H. Hempel. Apparatus for solidifying spirits. July 5.

5663. O. Bock. Continuous kilns. July 12.

8491. E. A. Vivinus and A. J. Hecht. Carburetters. June 28.

10,107. T. Torrance and J. R. Torrance. Mixing and grinding apparatus for the manufacture of white lead, paints, and other substances. July 5.

10,204. A. G. Brookes.—From F. Lorenz, successor to J. Lutjens, Germany. Process and apparatus for simultaneously drying and feeding, or conveying superphosphate and other materials. July 12.

10,355. W. P. Thompson.—From The Ransom Gas Machine Company, United States. Carburetting apparatus. June 28.

10,787. C. Timmann. Smokeless furnace. July 19.

10,883. O. P. Ostergren. Receptacles for holding and storing liquids, more particularly liquid air or liquefied gases. July 5.

10,885. L. Herlitschka. Centrifugal separators. July 12.

11,243. E. C. Hargrave. Utilisation of liquefied air or gas for cooling or refrigerating purposes. July 5.

11,771. L. Baggett. Apparatus for expressing liquids from solids. July 12.

II.—FUEL, GAS, AND LIGHT.

Applications.

12,885. Count G. de Roussy de Sales and L. Braly. Improvements in carburetters. Complete Specification. June 20.

12,893. C. R. Matthews. A gas- and air-tight charging funnel for acetylene gas apparatus. June 21.

12,938. J. E. Dowson. Improvements in the manufacture of generator gas and in apparatus used therewith. June 21.

12,950. R. Langhans. Improvements in the manufacture of incandescing media for lighting purposes. June 21.

13,016. W. E. Richards. Improvements in and relating to apparatus for containing and burning solid substitutes for alcohol. June 22.

13,017. W. E. Richards. Improvements in and relating to compositions for combustion as smokeless heat-producing media. June 22.

13,052. G. F. Sanders. Improvements in or connected with incandescent gas burners. June 23.

13,079. J. D. Forsyth and D. Forsyth. Improvements in apparatus for generating acetylene gas. June 23.

13,145. A. Husson. Improvements in acetylene generators. June 24.

13,155. E. Wright. Improvements in the manufacture of artificial fuel. June 24.

13,160. H. J. Dowsing. Improved means and apparatus for producing and utilising radiant heat and light. June 24.

13,209. J. Schäfer. Improvements in and relating to mantles for incandescent gas lights. June 26.

13,244. The Improved Electric Glow Lamp Company and A. Barnes. *See* Class VIII.

13,301. J. N. Goldbacher and E. Bournonville. Improvements in acetylene gas apparatus. Complete Specification. June 27.

13,310. H. Talbot. Improvements in lanterns for incandescent gas lighting. June 27.

13,325. F. W. C. Schniewind. Improvements in coke ovens and method of operating the same. Complete Specification. June 27.

13,339. G. C. Marks.—From The Pauli Lamp Company, United States. Improvements in and relating to self-generating and self-regulating acetylene gas-producing apparatus. June 27.

13,430. Sir C. S. Forbes, Bart. Improvements in apparatus for exhausting the residual products formed in the production of acetylene gas. June 28.

13,458. E. H. Wilkie. Improvements in apparatus for the production of the lime-light, especially with regard to lime-light jets. June 29.

13,572. J. B. Melhuish. An improved apparatus for the generation of acetylene or other gases. June 30.

13,662. J. H. Clarke, E. W. Sprott, and Acetylite, Ltd. Improvements in acetylene gas generating apparatus. July 1.

13,674. P. G. de Schodt. Improvements in and relating to apparatus for use in incandescent gas lighting and heating. Complete Specification. July 1.

13,723. L. J. F. Nicolai, and A. McNab. Improved means and apparatus for the production of gas specially intended for incandescent lighting and for heating purposes. Complete Specification. July 3.

13,786. R. H. Sutherland, F. Sutherland, and G. Marshall. Improvements in apparatus for generating acetylene gas. Complete Specification. July 4.

13,805. O. Imray.—From F. C. Wilson, United States. Improvements in apparatus for generating acetylene gas. Complete Specification. July 4.

13,817. C. Linzen, jun., E. Demmer, E. Disselkamp, E. Disselkamp, and R. Disselkamp. Improvements in stoves for lignite cakes, peat, and the like fuel. Complete Specification. July 4.

13,830. E. Besemfelder. Process and apparatus for the manufacture of coal-gas. July 4.

13,851. S. W. Ludbrook. Improvements in generator and other doors used in carburetted water gas plant. July 5.

13,888. J. M. Hadden. Improvements in illuminating gas apparatus. Complete Specification. July 5.

13,901. G. Hope. Improvements in and relating to acetylene lamps and generators, and to calcium carbide cartridges therefor. Complete Specification. July 5.

13,924. P. Lacroix. Improvements in acetylene gas generators. Complete Specification. July 5.

14,000. S. B. Apostoloff. Producing light by the incandescence or calorescence of a metal or metallic alloy. July 6.

14,010. J. S. Swinburne and C. H. Stearn. Improvements in means for use in the production of radiation and light by electricity. July 6.

14,072. H. S. Elworthy.—From J. Zuberbuhler, India. An improved automatic generator and storage vessel for acetylene gas. July 7.

14,124. P. van Hamont. An improved apparatus for the production of acetylene gas. Complete Specification. July 8.

14,239. O. Imray.—From Gesellschaft für Linde's Eismaschinen, Germany. An improved process and apparatus for manufacturing water-gas. July 10.

14,240. E. Quelle. Apparatus adapted mainly for the manufacture of acetylene gas. Complete Specification. Filed 10th July. Date applied for, 21st Dec. 1898, being date of application in France.

14,379. R. Goodwin. Composition for purifying acetylene gas. July 12.

14,457. J. Gridley. An improved firewood or fuel, and process of manufacturing the same. Complete Specification. July 13.

14,499. C. W. Soderberg. Improvements in apparatus for generating acetylene gas. Complete Specification. Filed July 13. Date applied for, Dec. 14, 1898, being date of application in Norway.

14,539. M. F. Harrison. Improvements in the method of and in apparatus for washing coal. Complete Specification. July 14.

14,556. F. Eldridge. Improvements in or relating to burners for use in incandescent gas lighting. July 14.

14,575. J. F. Simmance and J. Abady. Improvements in condensing apparatus for gas works. July 15.

14,624. P. A. P. Canova, W. Thompson, and G. Lorenzo. Improvements in or relating to the production of gases such as acetylene. July 15.

Complete Specifications Accepted.

1898.

13,830. A. J. Boult.—From O. Payan, France. Apparatus for producing acetylene gas. June 28.

16,884. J. Varon. Apparatus for the production of acetylene gas. July 5.

17,838. A. E. N. Yeadon and S. N. Yeadon. Washer and scrubber for purifying gas. July 12.

17,840. E. Thorp. Acetylene generators. June 28.

17,892. J. G. Lorrain.—From L. Ward, Cape Colony. Acetylene gas generating apparatus. June 28.

17,896. S. Pitt.—From The Pharmaceutical Institute, L. W. Gans, Germany. Production of incandescent materials suitable for use in electric lighting. July 12.

18,133. J. Kremer. Acetylene gas generators. June 28.

18,679. T. Clarkson and the Clarkson and Capel Steam Car Syndicate, Ltd. Burning of inflammable gas or vapour, and apparatus therefor. July 5.

19,087. C. W. S. Crawley. Illumination photometer. July 12.

19,106. G. Hansen and A. Kraetting. Portable generator of acetylene gas. July 12.

19,361. W. A. Drake and J. S. Marsland. Inclined gas retorts. July 19.

23,079. E. Disdier-y-Crooke. Utilisation of the gases issuing from blast furnaces and from coke ovens. July 12.

27,252. K. Gossweiler. Process for the production of acetylene gas. June 14.

1899.

63. A. J. Boult.—From A. M. Plaissetty ,France. Manufacture of incandescence mantles, filaments, and the like. July 12.

2226. F. Rhind. Acetylene gas generators. June 28.

7400. A. P. Anderson. Lamps for generating and burning acetylene gas. July 19.

7790. A. L. Lion. Method of and apparatus for the purification of gaseous bodies. July 12.

8370. J. Rousseau-Lemans. Fire-lighter. July 19.

8491. E. A. Vivinus and A. J. Hecht. *See* Class I.

9156. H. Eldridge, D. J. Clark, S. Blum, and A. A. Blum. Manufacture of calcic carbide and illuminating gases. July 12.

9743. A. H. Deike, A. W. Alexander, and J. Mitchell. Acetylene gas generators. July 12.

10,312. C. K. Mills.—From T. A. Edison, United States. Method of and apparatus for re-heating compressed air for industrial purposes. July 5.

10,705. J. B. de Léry. Incandescence gas burners. June 28.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Applications.

13,146. C. Döre. Improvements in the production of solid materials from tar and other substances. Complete Specification. June 24.

13,728. A. B. Singer and D. Hársanyi. Improved method and apparatus for the distillation of wood and other materials. July 3.

Complete Specifications Accepted.

1899.

7867. Actiengesellschaft für Theer- und Erdöl-Industrie and G. Kraemer. Process for the production of benzoic acid from coal-tar oil. July 12.

7868. Actiengesellschaft für Theer- und Erdöl-Industrie and G. Kraemer. Process for the purification of anthracene. July 12.

IV.—COLOURING MATTERS and DYES.

Applications.

12,762. O. Imray.—From Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of chlorindigo. June 19.

12,763. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of black colouring matters directly dyeing cotton. June 19.

13,165. H. R. Vidal. Improvements relating to the preparation of aromatic thio-derivatives adapted for dyeing cotton directly black. June 24.

13,178. I. Levinstein, F. Pollak, and Levinstein, Ltd. The manufacture of new sulphonic acids and of colouring matters and other products therefrom. June 26.

13,213. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new azo colouring matters, and of new intermediate products for the production of such colouring matters. June 26.

13,251. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of black colouring matters directly dyeing cotton. June 26.

13,533. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture or production of phenylglycin *o*-carboxylic acid. June 29.

13,905. R. B. Ransford.—From L. Cassella and Co., Germany. Improvements in the manufacture of colouring matters from polynitro derivatives of oxydialphylamines. July 5.

13,978. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Improvements in the manufacture of blue dyestuffs directly dyeing cotton. July 6.

13,979. O. Imray.—From Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of oximes of aromatic nitro compounds. July 6.

14,043. Cummings and Co. Brown leather edging dye. July 7.

14,117. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new colouring matters of the anthracene series. July 8.

14,151. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of substantive azo-dyestuffs derived from pure para-phenylenediamine. July 8.

14,152. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of anthraquinone derivatives, and dyestuffs therefrom. July 8.

14,138. F. Kehrmann. Manufacture of chloro-substitute rosindulines. July 10.

14,389. L. O. Helmers. Soluble sulphonic acid salts of alkaline earthy metals and metals proper and their sulphonic acids, and process of making same. July 12.

14,468. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new indoxyl derivatives. July 13.

14,479. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture of and production of new colouring matters of the anthracene series. July 13.

14,552. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. A new process for the production of indigo or its derivatives and of intermediate products for use therein. July 14.

14,639. G. W. Johnson.—From Kalle and Co., Germany. Improvements in the manufacture and production of colouring matters. July 15.

Complete Specifications Accepted.

1898.

14,962. J. Imray.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of sulpho-acids of aposafranines. June 28.

16,034. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany, Manufacture or production of new nitro-derivatives of the anthracene series. June 21.

16,201. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. New process for the production of indigo. June 28.

16,474. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of new colouring matters of the acridine series. July 19.

16,475. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of acridine derivatives. July 19.

17,366. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of acetyl compounds. July 19.

17,740. R. Holliday and Sons, Ltd., J. Turner, T. Turner, and H. Dean. Manufacture of colouring matters. July 5.

18,572. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of new disazo colouring matters. July 5.

18,737. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of blue dyestuffs for cotton. July 5.

19,009. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of blue dyestuffs of the anthraquinone series. July 19.

19,698. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of blue to bluish-green dyestuffs of the anthraquinone series. July 19.

1899.

7704. J. O. O'Brien, of the firm of W. P. Thompson and Co.—From M. Hazard-Flamand, France. Preparation of orthochlorophenol. June 28.

8083. A. Ashworth and J. Bürger. Production of colouring matters. July 5.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

12,969. R. H. Pickles and R. H. Pickles and Co. The use or application of certain substances in stiffening, sizing, or otherwise preparing textile fabrics and paper. June 22.

13,135. W. G. Heys.—From H. Danzer, France. Improved condensed and automatic apparatus to be employed in the preparation of wools for washing and cleansing. June 24.

13,182. J. F. White and E. Holt. Improvements in the method of and apparatus for drying wool and the like. June 26.

13,237. A. Wolstenholme. Improvements in rubbing aprons, for use in the manufacture of worsted yarns. Complete Specification. June 26.

13,330. J. Imray.—From The Consortium Mulhousien pour la fabrication de fils brillants, Germany. Improvements in the production of cellulose solutions adapted for spinning. June 27.

13,331. J. Imray.—From The Consortium Mulhousien pour la fabrication de fils brillants, Germany. An improvement in the production of cellulose solutions adapted for spinning. June 27.

13,433. H. H. Lake.—From J. T. Van Gestel, United States. An improved method of and apparatus for treating fabrics to render them waterproof, applicable also to the treatment of fabrics to fix the dye thereof. June 28.

13,514. G. Grandage. Improvements in apparatus for mercerising cotton or other piece goods. Complete Specification. June 29.

13,635. T. Gill. A machine for drying and conditioning wool, worsted, cotton, jute, hemp, or other material, or yarns made from any of the above-mentioned materials. July 1.

13,729. E. H. Fuller. Improvements in or relating to the production of ornamental effects upon textile fabrics, and in apparatus therefor. Complete Specification. July 3.

13,775. H. T. R. Stuart, W. Pickup, and W. Knowles. Improvements in machines for mercerising woven fabrics. July 4.

13,945. E. J. de Courcey and R. Crawford. New or improved machinery for scutching and cleaning flax. July 6.

14,113. J. Grime. Improvements in the treatment of textile fabrics with caustic alkalis. July 8.

14,232. E. Maertens. A new or improved process and apparatus for cleaning wool and other animal fibres. Complete Specification. July 10.

14,329. P. Jeanmaise. Improvements in mercerising apparatus. Complete Specification. July 11.

14,382. H. K. Tompkins and W. A. E. Crombie. Improvements in the manufacture of fibres for textile and other purposes. July 12.

14,525. J. Chaubert. New process for the preparation of cellulose for the production of threads and films. July 14.

14,558. A. M. P. Bouilliant. Improvements relating to the preparation and treatment of textile fibres. July 14.

14,606. D. Macfarlane and T. S. Macfarlane. Improvements in apparatus for use in mercerising yarns. July 15.

Complete Specifications Accepted.

1898.

22,104. M. G. Olivier. Product and process for rendering stuffs, tissues, paper, feathers, furs, and the like impermeable. July 19.

1899.

4689. W. Schmidt. Apparatus for use in treating textile materials and the like with liquids. June 28.

10,875. A. J. Boult.—From E. Rheinbach, Germany. Fabric particularly applicable for use as a lining material. July 5.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, and BLEACHING.

Applications.

12,946. J. Pullman and E. E. Pullman. Improvements in the process of treating for the purpose of scouring and bleaching vegetable fibres and yarn, and woven fabrics made from such fibres. June 21.

13,071. W. J. Engledue. Improvements in or relating to bleaching. June 23.

13,372. W. G. Heys.—From E. E. Plantron, France. Improvements in and in connection with bleaching, dyeing, washing, and similarly treating textile materials. June 28.

13,541. J. Rhodes. Improvements in apparatus for scouring, dyeing, washing, and similarly treating yarn, slubbing, wool, and other fibrous material. June 30.

13,578. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. A new process for dyeing cotton. June 30.

13,657. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Improvements in dyeing cotton without previous mordanting. July 1.

13,872. W. Coventry. Improvements in spindles used for holding yarn during dyeing and the like operations. Complete Specification. July 5.

14,032. B. Cohnen. A machine for mercerising, dressing, mordanting, washing, dyeing, and in general impregnating yarns. Complete Specification. July 7.

14,458. T. R. Shillito.—From J. R. Geigy and Co., Switzerland. Dyeing process. July 13.

14,528. J. Lindley and E. Ashworth. Improvements in the method of and in apparatus for the dyeing, bleaching, and treatment of cotton and other textile materials. July 14.

Complete Specifications Accepted.

1898.

16,893. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Method for the production of fast colours on the wool fibre from picramic acid monazo dyestuffs. July 5.

17,075. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning. Method for the production on the fibre of the azo colours soluble in water in tints varying from violet-black to dark-black tints. July 5.

17,558. W. Turner. Awking machines for indigo dye vats. July 19.

17,797. F. L. Bartlet. Washing and bleaching compound for vegetable fibre or textiles. July 19.

1899.

4568. A. A. Vanzeveren. Apparatus for mechanically dyeing combed wool in bobbins, raw wool and cotton June 28.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

13,048. W. H. Bowers. Improvements in and connected with apparatus for the production of acetic acid from acetates of lime and soda, or from other substances containing acetic acid. June 23.

13,320. O. Hofmann. Improvements in treating cupric sulphate solutions. Complete Specification. June 27.

13,429. J. Y. Johnson.—From F. Hasslacher, Germany. The manufacture and production of alkali calcium phosphates. June 28.

13,439. La Société Anonyme des Manufactures de Produits Chimiques du Nord and E. Boullanger. Improvements in the manufacture of lactic acid. Filed June 28. Date applied for, Jan. 28, 1899, being date of application in France.

13,771. P. Naef. Method and apparatus for producing alkali and chlorine, in parts applicable for other purposes. July 4.

14,261. A. J. Boult.—From W. S. Horry, United States. Method of producing carbide of calcium. Complete Specification. July 11.

14,644. F. W. Golby.—From Matray Frères and Co., France. A process for agglomerating the liquid or doughy chloride of sodium into compact blocks. July 15.

Complete Specifications Accepted.

1898.

18,283. C. O. Weber, C. F. Cross, and J. Frakenburg. Manufacture of cellulose tetracetate. July 5.

19,446. H. Blumenberg, jun. Manufacture of peroxides. July 12.

19,767. J. Raschen and The United Alkali Co., Ltd. Apparatus for the manufacture of cyanides and ferrocyanides from sulpho-cyanides, and the recovery of by-products. July 19.

19,907. A. J. Boult.—From A. F. Izidore and M. Biscons, France. Recovery of nitrous gases in the manufacture of sulphuric acid. July 19.

24,978. J. Dekker. Process and apparatus for crystallising sodium carbonate and other similar salts in small crystals. July 19.

1899.

5926. F. J. Bergmann. Process for producing pure acetic acid. July 5.

10,757. A. J. Boult.—From The Pratt Process Company, United States. Manufacture of sulphuric acid. July 19.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

12,764. R. Stanley. Improvements in the manufacture of bricks, tiles, pipes, terra-cotta or pottery ware, and such-like goods. June 19.

13,028. W. C. Lawton. Improved method or process of producing designs in colours on china, pottery, and like ware. June 22.

13,163. J. Noad and T. H. L. Bake. Improvements in glazing or enamelling compounds for pottery. June 24.

13,244. The Improved Electric Glow Lamp Co. and A. Barnes. Improvements in the manufacture of reflecting opalescent surfaces for electric lamps or glass reflectors. June 26.

14,170. A. Mountford and F. Mountford. Improved apparatus for use in connection with machines or apparatus used for decorating pottery-ware, glassware, and the like. July 10.

14,424. J. Hobson. Improved portable apparatus or appliances for use in decorating ceramic-ware and the like. July 13.

Complete Specifications Accepted.

1898.

12,885. G. Pelmear, W. H. Cummings, and W. R. Meggeson. A substitute for glass. July 12.

1899.

5178. W. F. Altenbaugh. Machines for automatically gathering and delivering glass in manufacturing glassware. July 12.

5179. W. F. Altenbaugh. Machines for automatically gathering and delivering glass in manufacturing glassware. July 12.

10,311. A. Travaglini and J. B. Hall. Dies for use in the manufacture of mosaics. July 12.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

12,836. C. Schneider. Improved process of manufacturing fireproof stones. June 20.

12,871. W. Borgolte, sen. Improvement in the manufacture of cement. Complete Specification. June 20.

12,985. J. C. Sellars. Improvements connected with packages of cement. Complete Specification. June 22.

13,159. L. Jouannet. Improvements in plaster or cement floors, ceilings, partitions, and the like. June 24.

13,238. G. X. Dime. Fireproofing composition. Complete Specification. June 26.

13,423. H. C. Williams. Improvements in the treatment of wood. June 28.

13,595. C. L. Booth. Improvements in the construction of drying rooms or chambers, especially suitable for treating cement, slurry, and the like. June 30.

13,645. J. Knight. Artificial stone slabs and cable channels. July 1.

13,665. F. Heyden. An improved process for producing artificial marble. Complete Specification. July 1.

13,944. E. Springborn. A new method for making unburnt bricks for building purposes and the like. July 6.

14,038. R. S. Smethurst. An improved material to be used as a waterproof covering for roofs, or as a substitute for glass and other like purposes. July 7.

14,201. W. Dudman. Brandon artificial flint stone combined paving. July 10.

14,602. F. Hoeniger. Improvements in concrete, cement, and similar plates and slabs. Complete Specification. July 15.

14,612. W. Owen. Improvements in or relating to the manufacture of artificial stone. July 15.

Complete Specifications Accepted.

1898.

14,394. W. Antony. Process for and method of producing slabs for building and other purposes. July 5.

16,489. W. Olschewsky. Process of and appliances for producing artificial stone. June 28.

18,654. J. Steiger. Manufacture of hydraulic cement. July 5.

19,633. G. Collantier. Coating material for decorating and building purposes. July 12.

21,073. C. D. Abel.—From C. Westphal, Germany. Process for hardening artificial stone. July 19.

1899.

7489. B. Liban. Kilns for the manufacture of cement. July 5.

9671. J. Schenkel. Process and material for impregnating wood and the like. June 28.

11,687. W. L. Wise.—From G. F. Culmer and G. E. K. Culmer, United States. Asphaltic fluxes, and manufacture thereof. July 12.

X.—METALLURGY, MINING, Etc.

Applications.

12,711. R. H. Wainford. Improved casting or molten metal-pouring apparatus or plant. June 19.

12,749. W. Duncan. Improved means for mixing and aerating sands or tailings, while under treatment by solvents. Complete Specification. June 19.

12,830. J. Baxeres de Alzugaray. Improvements in obtaining oxides from ores and the like. June 20.

12,831. J. Baxeres de Alzugaray. Improvements in and connected with the manufacturing of metallic chlorides. June 20.

12,910. H. Jaeger. Process and apparatus for the manufacture of stannic acid (oxide of tin); applicable also for treating other metals. Complete Specification. June 21.

13,010. A. Reynolds. Improvements in blast and cupola furnaces. June 22.

13,554. T. C. Hutchinson. An improved treatment of blast furnace slag or other vitreous material for the production or manufacture of slag wool or silicate cotton. June 30.

13,585. T. T. Heaton. Improvements in welding or uniting metals, and more particularly aluminium or its alloys. June 30.

13,615. J. Ranald. Improvements in the extraction of bismuth from ores containing bismuth oxide or bismuth oxide and sulphide. June 30.

13,670. R. A. Hadfield. Improvements in manufacture of steel castings such as projectiles. July 1.

13,672. The Golden Link Consolidated Gold Mines, Ltd., and H. J. Phillips. New or improved process for extracting precious metals from their ores. July 1.

13,756. W. J. Engledue. Improvements in or relating to the treatment of sulphide ores. July 3.

13,874. A. Eadie. Improvements in the construction of cupolas and the like. July 5.

13,893. H. Timmler. Improvements in annealing furnaces. Complete Specification. July 5.

13,925. J. F. Kester and F. A. Hecht. Improvements in self-fluxing solder. Complete Specification. July 5.

13,967. A. Sweetser. Improvements in methods of casting or moulding metals and alloys, and apparatus therefor. July 6.

13,969. B. T. Moore and H. G. Ticehurst. Improvements in or relating to fuses for mining purposes. July 6.

14,028. C. F. Poppleton. Machine for galvanising, or otherwise coating with metal, sheet iron or steel. July 7.

14,082. P. L. T. Héroult. A process for obtaining rich ferro-chromium. Filed July 7. Date applied for, Dec. 30, 1898, being date of application in France.

14,219. H. Theis. Improved shot-proof armour. Complete Specification. July 10.

14,226. A. G. Brookes and P. Aulich, Germany. A process of manufacture of aluminium and magnesium alloys. Complete Specification. July 10.

14,278. J. Swinburne and E. A. Ashcroft. Improvements in the treatment of sulphide and other ores. July 11.

14,324. R. Fiedler. An improved process for silver-plating. Complete Specification. July 11.

14,376. W. Littleton. Improved heated blast cupola. July 12.

14,592. H. Bumb. An improved mode of making alloys of magnesium. Complete Specification. July 15.

14,637. E. Appart. A process for utilising metal refuse. Filed July 15. Date applied for, Jan. 18, 1899, being date of application in Belgium.

14,640. S. O. Cowper-Coles. Improvements in cleaning or preparing, and coating with zinc, iron or steel. July 15.

Complete Specifications Accepted.

1898.

14,523. H. R. Angel. Furnaces for treating sulphides containing zinc and other ores. July 12.

16,312. J. Armstrong. Smelting of complex sulphide ores containing zinc and lead. July 12.

16,388. J. Armstrong. Extraction of zinc from its ores. July 12.

16,399. J. J. Hood. Gold and silver extraction. June 28.

18,604. G. Wolfram. Process for the production of the light metals (potassium, sodium) and anhydrous oxides, and peroxides and cyanides of these metals. July 19.

1899.

7603. A. L. Walker. Apparatus for casting metals. July 12.

8643. G. W. Johnson.—From The Wellman-Seaver Engineering Co., United States. Apparatus for the manufacture of steel. June 28.

XI.—ELECTRO-CHEMISTRY and ELECTRO-METALLURGY.

Applications.

12,730. P. Offenbroich and H. Rockel. Improved galvanic cell. June 19.

13,074. P. Schoop. Improvements in apparatus for electrolysis. June 23.

13,274. A. Schanschieff. Improvements in the manufacture of accumulators. June 27.

13,329. R. Haddan.—From Berliner Accumulatoren und Electricitätsgesellschaft mit beschränkter, Germany. Improvements in electrode plates for accumulator batteries. June 27.

13,341. E. Edser and R. W. Weekes. Improvements relating to the electrolytic decomposition of alkaline salts. June 27.

13,593. D. Tommasi. Improvements in secondary batteries. Filed June 30. Date applied for, Jan. 23, 1899, being date of application in France.

13,731. G. V. Lagarde. Improvements in electric accumulators or storage batteries. July 3.

13,732. C. E. Lee. Improvements in electrical storage batteries. Complete Specification. July 3.

13,826. L. Tobiansky. Elastic and permeable electrodes for storage batteries. Complete Specification. July 4.

13,846. W. J. Cordner. Improvements in and relating to the manufacture of a composition for rhea fibre, applicable for electric insulation and other purposes. July 4.

13,907. C. H. Elliot and E. J. Fumber. Improvements in the manufacture of primary batteries. July 5.

14,300. W. C. Callmann. Improvements in primary batteries. Complete Specification. July 11.

14,501. R. Hills and J. Matthews. An electrical accumulator or secondary battery. July 14.

Complete Specifications Accepted.

1898.

14,726. W. Rowbotham. Primary batteries. July 5.

14,809. W. H. Smith and W. Willis. Electric accumulators or storage batteries, and the manufacture of plates or electrodes therefor. July 12.

16,876. E. J. Clark. Secondary electric batteries or accumulators. July 19.

17,458. A. A. Beadle. Primary electric batteries. June 28.

17,780. J. T. Niblett and M. Sutherland. Electric storage batteries. July 12.

18,702. A. Schanschieff and A. E. Hodgson. Electricity accumulators. July 5.

18,522. W. Thomson, Baron Kelvin of Largs. Electrolytic apparatus for the production of alkali. July 5.

19,536. S. W. Maquay and P. E. Vanderpump. Primary batteries. July 19.

1899.

7005. P. M. Justice.—From The Pope Manufacturing Company, United States. Electric storage batteries. July 19.

10,205. R. Gironard. Liquid feed devices for electrolytic and kindred apparatus. July 19.

10,215. M. Haas. Electrolytic apparatus. June 28.

10,317. E. L. Dessolle. Electro-plating process, and apparatus therefor. June 28.

10,320. H. Carmichael. Electrodes and electrode connections in liquid feed devices for electrolytic apparatus, and construction of enclosing vessels for electrolytic and kindred apparatus. July 19.

10,911. A. Pfannenberg. Primary batteries. June 28.

12,171. W. E. Case. Galvanic cells. July 19.

12,172. W. E. Case. Galvanic cells. July 19.

12,309. P. A. Newton.—From The Knickerbocker Trust Co., United States. Storage batteries and methods of preparing electrodes therefor. July 19.

XII.—FATS, OILS, AND SOAP.

APPLICATIONS.

13,119. G. A. F. Krumm. An improved cleansing composition or wash for linen and the like. Complete Specification. June 24.

13,912. J. Gommesen. *See* Class I.

14,027. H. B. Kearney. A new or improved manufacture of "soap" for washing or scouring wool and other animal fibres; also applicable for washing other fibrous fabrics. July 7.

14,371. W. L. S. van Loo. Improvements in the manufacture of soap. July 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1898.

7242. J. Hertkorn. Process for the rapid oxidation of drying oils and their fatty acids by mixing and airing the same with pulverised substances for the preparation of linoleum and cork sheeting. July 5.

14,570. E. Andreoli. Treatment of fatty matters for deodorising and decolorising the same. June 28.

15,838. H. Hadfield. Soap frames used in the manufacture and slabbing of soap. June 28.

1899.

11,602. C. Frowein. Oil-purifying apparatus. July 12.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, ETC.

APPLICATIONS.

13,188. C. T. Hennig. Method of manufacturing whiting. June 26.

13,499. E. L. Lefranc. Improved process of grinding colours employed for ceramic purposes. June 29.

14,068. R. W. James.—From G. D. Coleman, United States. Improved method of and means for the application of anti-fouling coating for the wooden surfaces of submerged structures. July 7.

14,069. R. W. James.—From G. D. Coleman, United States. Improved method of and means for the application of anti-fouling coating for metallic submerged structures. Complete Specification. July 7.

14,227. W. R. Lake.—From F. A. M. Kaempff, Germany. A process for the production of a material or substance resembling ebonite. Complete Specification. July 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1898.

18,008. J. Anderson, jun. Method of and means for dissolving india-rubber. July 12.

1899.

9028. S. Banner. Manufacture of copal varnish and other like varnishes, and solvents applicable therefor. July 5.

10,820. A. E. J. V. J. Theilgaard. Process of disvulcanising caoutchouc, india-rubber, gum, elastic, and similar materials.

10,821. A. E. J. V. J. Theilgaard. Process of disvulcanising caoutchouc, india-rubber, gum, elastic, and similar materials. June 28.

10,822. A. E. J. V. J. Theilgaard. Process of disvulcanising caoutchouc, india-rubber, gum, elastic, and similar materials. June 28.

11,159. A. J. Boult.—From A. H. Marks, United States. Process for reclaiming rubber waste. July 5.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

APPLICATIONS.

13,307. L. Consonno. Improvements in the treatment and tanning of hides and skins. Complete Specification. June 27.

13,357. G. S. Wolff. Improvements in enamelled leather and in enamel for producing the same. Complete Specification. June 27.

13,532. A. J. Boult.—From P. A. D. Prost and A. Godard, France. Improvements in or relating to the tanning and treatment of leather and skins. June 29.

13,563. C. O. Natusch. Improvements in the process of tanning. June 30.

13,713. J. H. Curling and Curling's Tannery, Ltd. Improvements in apparatus for pit tannage. July 3.

COMPLETE SPECIFICATIONS ACCEPTED.

1898.

14,220. G. D. Burton. Process of tanning hides or skins of animals, &c. June 28.

14,221. G. D. Burton. Unhairing all kinds of animal skins. June 28.

1899.

9251. G. W. Glazier. Machines for softening hides and skins. July 12.

XV.—AGRICULTURE AND MANURES.

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

4714. A. Wenck. Manufacture of artificial manures. July 19.

10,204. A. G. Brookes.—From F. Lorenz, successor to J. Lutgens, Germany. *See* Class I.

XVI.—SUGARS, STARCHES, GUMS, ETC.

APPLICATIONS.

12,703. The Westburn Sugar Refineries, Ltd., and R. F. Lyle. Improvements in treating icing sugar. June 19.

13,096. D. Finkler. The manufacture of albumose. June 23.

13,252. E. Fromm and T. V. Bredt. Manufacture of a high-grade albumin preparation from rape seed and rape seed cake. June 26.

14,356. D. Stewart. Improvements in high-pressure clarifying apparatus for saccharine solutions. July 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1898.

16,540. J. Robin-Langlois. Process and apparatus for the rapid refining of sugar. July 5.

16,979. F. M. Spence and D. D. Spence. Manufacture of syrups and beverages. July 19.

17,650. C. Brueder. Treatment of fecula and other amylaceous matters by means of alkaline chlorites or hypochlorites for the purpose of obtaining a gummy and gelatinous product. July 12.

18,143. W. P. Thompson.—From J. C. Boot, Java. Purification of syrup, molasses, and the like. July 12.

19,961. W. P. Thompson.—From H. A. J. Manoury, France. Method of refining raw sugar. July 19.

1899.

11,416. M. D. Petersen, *née* Christiansen. Manufacture of laundry starch. July 5.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

12,819. A. J. Boult.—From G. Sändker, Belgium. An improved method and apparatus for the production of alcohol. June 20.

13,245. J. Topf. Improvements in kilns for drying malt. Complete Specification. June 26.

14,150. A. Grauaug and J. Krauz. Process and apparatus for accelerating alcoholic fermentations, and at the same time obtaining pure carbon dioxide. Complete Specification. July 8.

14,359. E. Andreoli. Improvements in and relating to the disinfection or purification of foul casks or like vessels. July 12.

14,487. P. M. Justice.—From The Countess Romain de Diesbach, *née* Jeanne de Beaurepaire, Louvagny, France, and C. Sudre, Belgium. Improvements in the treatment of distillers' wash. July 13.

14,488. P. M. Justice.—From The Countess Romain de Diesbach, *neé* Jeanne de Beaurepaire, Louvagny, France, and C. Sudre, Belgium. Improvements in the treatment of distillers' wash. July 13.

14,587. J. McKenny. Improvements relating to the maturing of whisky and other spirituous liquors. July 15.

Complete Specifications Accepted.

1898.

15,151. M. Otto. Process of and apparatus for the sterilisation of liquids by means of ozone. July 19.

15,833. E. A. Hamlyn. Apparatus for drying brewery and distillery by-products and the like materials. June 28.

1899.

2673. H. Hempel. *See* Class I.

10,195. A. Müller. Apparatus for use in boiling and treating hops. June 21.

XVIII.—FOODS, SANITATION, Etc., and DISINFECTANTS.

Applications.

A.—Foods.

12,992. F. Cowin. Improvements in and relating to the preservation of meat. Complete Specification. June 22.

13,744. W. Lanwer and E. Rüping. Process of preserving perishable food and other materials against infection, atmospheric and other influences. Complete Specification. July 3.

13,966. C. S. Meacham. Improvements in apparatus for sterilising milk, bottled fruit and the like, and also for the steam cooking of food. July 6.

14,006. R. R. Harvey. Improvements relating to the production of organic extracts and serums of the blood containing organic ferments, and their application to mammalian animals, principally for increasing the milk of dairy cattle and fattening of stock, and for other purposes. Complete Specification. July 6.

14,288. H. A. Sévigné. Improvements in or relating to methods of preserving bread. Complete Specification. July 11.

14,537. H. O. Blaker. Improvements in and relating to sterilisers for milk and other substances. July 14.

B.—Sanitation.

12,793. G. A. Abbott. An improved manufacture of filtering material. June 19.

13,864. F. E. Priest. Improvements connected with liquid purification plants. July 5.

Complete Specifications Accepted.

A.—Foods.

1899.

1878. A. L. Lawton and A. W. Lawton. Method of and apparatus for preserving fruits, &c. July 12.

B.—Sanitation.

1898.

16,970. C. J. Lomax. Machine for the extraction of liquid from sewage sludge and other substances. July 5.

21,954. C. Wegener. Furnaces for burning refuse and treating the slag therefrom. July 12.

C.—Disinfectants.

1898.

18,511. J. L. Wade. Sulphur candles and their containing vessels. July 12.

26,983. A. Planner. Disinfectants and antiseptics. July 12.

1899.

7266. T. de Grey and F. Roth. Preparation of phenol for antiseptic and other purposes. June 28.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

12,969. R. H. Pickles and R. H. Pickles and Co. *See* Class V.

13,287. J. Chaubert. Improved composition for the manufacture of celluloid. June 27.

13,330. J. Imray.—From The Consortium Mulhousien pour la fabrication de fils brillants, Germany. *See* Class V.

13,331. J. Imray.—From The Consortium Mulhousien pour la fabrication de fils brillants, Germany. *See* Class V.

14,138. W. Friese-Greene. Improvements in the manufacture of paper for inkless printing. July 8.

Complete Specifications Accepted.

1898.

16,096. S. Litynski, A. Rodakiewiez, and F. Kurowski. Rendering fireproof wood, textile fabrics, paper pulp, straw and the like. June 28.

19,324. W. A. Hall. Manufacture or treatment of paper. July 19.

26,747. C. Vallot and E. Pauze. Process of incrustation of metals or minerals in paper stuffs and the like. July 19.

1899.

9716. J. F. Bennett and W. Appleyard. Treatment of cardboard, paper and wood pulp and other substances of a fibrous or porous nature, and of articles made therefrom. July 12.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Applications.

12,882. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. The manufacture and production of condensation products from phenols and alloxan. June 20.

12,942. E. Miran and F. Schwarz. Improvements in the preparation of perfumes. June 21.

13,455. W. Smith. Improvements in the manufacture or production of eucalyptol from eucalyptus oils. June 29.

13,533. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture or production of phenylglycin-*o*-carboxylic acid. June 29.

13,703. J. F. von Mering. Manufacture of tethylmorphine. July 3.

13,899. A. J. Boult.—From L. Bernegau, Germany. Improved method of treating kola nuts and products obtained thereby. July 5.

14,233. G. H. Benjamin. A process for manufacturing diethylether. July 10.

14,236. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of artificial perfumes. July 10.

14,315. E. R. Blundstone. Improvements in the production of artificial perfumes. July 11.

14,388. L. O. Helmers. Preparations of albumine and sulphonized carbon compounds, and process of making the same. July 12.

14,565. E. Taeschner. Process for producing a fluid extract of thyme. July 14.

Complete Specifications Accepted.

1898.

15,907. J. L. Hawliczec. Manufacture of acetone. July 19.

16,994. H. S. Wellcome and S. B. Schryver. Manufacture of fine chemical products for use in pharmacy and other purposes. July 19.

19,103. A. J. Boult.—From R. Wagnitz, Germany. Manufacture of new chloral combinations. July 19.

19,868. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of an aromatic ether. July 19.

1899.

7184. W. P. Thompson.—From K. Schwickerath, United States. Process of extracting nuclein from yeast, and preparing compounds of such nuclein with iron, silver, and mercury soluble in water. July 19.

7704. J. O. O'Brien of the firm of W. P. Thompson and Co.—From M. Hazard, Flamand, France. *See* Class IV.

XXI.—PHOTOGRAPHY.

Applications.

13,402. C. Vandyk. Improved method of "finishing" photographic prints. June 28.

13,568. A. W. Penrose and W. Gamble. Pressure plate for photographic dark slides used in the "Lippmann Process" of colour photography. June 30.

13,666. G. Selle. Improvements in the method of and means for producing images in complementary colours, suitable also for use in taking, projecting, inspecting, testing, or combining three-colour photographs, prints, or the like. July 1.

13,832. W. P. Wethered. Improvements in apparatus for treating photographic plates and films. July 4.

13,903. C. Raleigh. An improved method of and apparatus for conducting certain photographic operations, principally applicable in connection with "animated" photography. July 5.

Complete Specifications Accepted.

1898.

17,167. C. Dicker. Production of coloured photographs. June 21.

18,697. J. C. Chorley. Method of and means for producing cellulose films for photographic and other purposes. July 5.

18,875. W. White. Apparatus for producing and exhibiting colour photographs. July 19.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

13,171. E. H. Durnford and G. H. Wadsworth. Improvements in the manufacture of smokeless powder. June 24.

13,232. H. P. Hurst. Improvements in or connected with high explosive projectiles and in detonating fuses and attachments or fittings therefor. Complete Specification. June 26.

13,247. W. E. Miller. Improvements in and connected with mining 'caps or cartridges. Complete Specification. Filed June 27. Date applied for Dec. 8, 1898, being date of application in United States.

13,278. A. Hollings. Improvements in the manufacture of guncotton and in apparatus therefor. June 27.

13,705. R. H. Jude. An improvement in the manufacture of matches free from yellow phosphorus, which strike on surfaces not specially prepared. July 3.

13,769. J. W. Reno. Improvements in explosive shells. July 4.

13,972. G. E. Davis and A. R. Davis. Improvements in apparatus for the manufacture of ammonium nitrate. July 6.

14,648. E. H. Durnford and G. H. Wadsworth. Improvements in the manufacture of explosives. July 15.

Complete Specifications Accepted.

1898.

8470. A. T. Dawson and J. Karstairs. Manufacture of explosives. July 19.

15,553. F. W. Jones. Treatment of explosives. July 19.

16,037. The firm of Bohy, Gallay, and Co. Manufacture of matches. July 12.

17,878. C. W. Curtis and A. H. Durnford. Manufacture of gunpowder. July 5.

18,002. C. F. Hengst. Smokeless and waterproof explosive compound. July 12.

18,233. A. Luck and C. F. Cross. Treatment of nitrocellulose. July 5.

18,868. A. Luck and C. F. Cross. Treatment of nitrocellulose. July 5.

1899.

6656. P. M. Justice.—From The Marsden Company, United States. Material suitable for engine packing, the manufacture of dynamite and other purposes, and of preparing and treating same. July 5.

8409. R. F. Leuschel. Process for the production of an explosive substance for fire arms. July 19.

XXIII.—ANALYTICAL CHEMISTRY.

Application.

14,029. V. Durant. Improved process for analysing milk, milk products, and other fatty solid or liquid matters, and apparatus therefor. Complete Specification. July 7.

PATENTS UNCLASSIFIABLE.

Application.

14,339. O. Efrém and J. Klaudy. Process for the production of substances of great catalytic activity. July 11.

Complete Specification Accepted.

1898.

22,029. C. O. Weber, C. F. Cross, and J. Frankenburg. Manufacture of cellulose esters. July 5.

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Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—p. 7819.

THE JOURNAL

OF THE

Society of Chemical Industry.

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 8.—Vol. XVIII.] **AUGUST 31, 1899.** [Non-Members 30/- per annum; Members 21/- per Set of extra or back numbers; Single Copies (Members only) 2 6.

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Frankland, Sir Edward, K.C.B., F.R.S., The Yews, Reigate Aug. 9.

Obituary.

Sir EDWARD FRANKLAND, K.C.B., F.R.S., LL.D., &c.

Member of the Society of Chemical Industry.

Sir Edward Frankland died, after but a few days' illness, on August 9, just a week before the decease of his old teacher, Bunsen, whose obituary follows. He was born on January 18, 1825, at Churchtown, near Lancaster, and was educated at the Grammar School of his native town, whence he proceeded to the Museum of Practical Geology, where he continued his studies under Dr. Lyon Playfair (afterwards Lord Playfair). He then for a time migrated to the Continent, and at the Universities of Marburg, under Bunsen, and Giessen, under Liebig, he completed a successful academical career. In 1850, Frankland announced his discovery of the preparation of compounds of zinc with methyl and ethyl—a discovery pregnant with theoretical deductions, which he used to form the basis of his doctrine of atomicity or equivalence of the elements. In 1851 he was appointed Professor of Chemistry in the then recently founded Owens College, Manchester. Six years later he was elected to the professorship of chemistry at St. Bartholomew's Hospital, and in 1863 was appointed Professor of Chemistry in the Royal Institution. This post he resigned two years afterwards to accept the professorship in the Royal College of Chemistry (School of Mines). In 1868, Frankland was appointed a member of the second Royal Commission on the Pollution of Rivers, and the Government provided him with a splendidly equipped laboratory for the purposes of his work of research.

Of the many publications from the pen of Sir Edward Frankland, the following are some of the most important:—Reports to the Local Government Board on "The Chemical and Bacteriological Condition of the Metropolitan Water Supply," "Lecture Notes for Chemical Students," "Experimental Researches in Pure, Applied, and Physical Chemistry," "The Source of Muscular Power," "Water Analysis for Sanitary Purposes," and "Contributions to the Knowledge of the Manufacture of Gas." He was a corresponding member of the French and Vienna Academies of Science, Foreign Member of the Royal Academy of Sciences in Bavaria, and of the Academies of Science of Berlin and St. Petersburg; honorary member of the Societies of Natural Sciences of Switzerland and of Göttingen, of the Chemical Societies of Germany, America, and Lehigh University; and was honorary Foreign Secretary of the Royal Society. Her Majesty was pleased, upon the celebration of her Diamond Jubilee, to confer upon him the distinction of a K.C.B.

Sir Edward Frankland was twice married: first in 1851 to Sophie, daughter of Herr F. W. Fick, of Capel; and secondly, in 1875, to Ellen Frances, eldest daughter of Mr. C. K. Grenside, of Oakfield, Wimbledon.

His death took place at Golan, Gudbrandsal, Norway, whither he had betaken himself for some salmon fishing—a sport of which he was very fond.

PROF. ROBERT WILHELM BUNSEN, F.R.S.

At Heidelberg, on Wednesday, August 16th, R. W. Bunsen died, aged 88 years, just one week after the death of one of his most distinguished pupils, Sir Edward Frankland. Robert Wilhelm Bunsen was born on March 31, 1811, at Gottingen, his father being a distinguished theologian. He graduated at Göttingen University as Ph.D. in 1831. After spending a few years in study at Paris, Berlin, and Vienna, in 1836 he succeeded Wohler as Professor of Chemistry in the Polytechnic School at Cassel. Two years later he went to Marburg; then, in 1852, after a short interval at Breslau, he was appointed to the chair of chemistry at Heidelberg, where he remained until his resignation in 1889. The last 10 years of his life have been spent in retirement. He retained his faculties to the end, although troubled with slight deafness. In England the Royal Society—which in 1858 elected him one of its foreign members—awarded him the Copley medal in 1860, and 17 years afterwards chose him and his fellow-worker Kirchhoff to be jointly the first recipients of the newly-instituted Davy medal. As a "Privatdocent" in his native university he first showed his ability in the prosecution of a difficult and dangerous investigation upon that series of poisonous and explosive organic compounds of arsenic, the cacodyl series. This work nearly cost him his life, and lost him one of his eyes. His many famous discoveries and inventions include the Bunsen battery and the Bunsen gas burner.

In conjunction with Berthold he discovered that fresh ferric hydrate was an antidote to arsenic.

To Bunsen we owe the separation of yttrium and erbium, and the discovery of cæsium and rubidium. Of his other investigations, there may be mentioned those on the chemistry of blast-furnace gases, in conjunction with the late Lord Playfair; on actinometry and the chemical action of light, with Sir Henry Roscoe; and on the geological conditions of Iceland and the theory of the geysers, the result of a visit to that island in 1847. Perhaps, however, Bunsen's most important achievement was the discovery, in conjunction with Kirchhoff, of spectrum analysis. In the death of Bunsen, chemistry has lost a giant mind, and one of her most renowned and successful teachers.

Journal and Patent* Literature.

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* Any of these specifications may be obtained by post by remitting 8*d.*—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

I.—PLANT, APPARATUS, AND MACHINERY.

Chemical Reactions under High Pressures, A Method for Carrying out. **B. H. Hite. Amer. Chem. J. 1899, 22, [1], 80—86.**

A method is described and illustrated, by which reactions may be studied at high pressures limited only by the crushing strength of steel. The reagents are contained in a platinum tube made of thin foil, 4 ins. long and ¾ in. in diameter, similar to a compressible paint tube. These paint tubes may themselves be used when they would be unattacked by the reagents. The thin tube is placed in a lead tube, 5—6 ins. long, and 1¼ ins. in diameter, which is then filled with water and closed with a lid (Fig. 1). The lead tube fits into a steel cylinder, the bore of which must be true and smooth, and fitted accurately by the piston. The lead tube is securely sealed by the pressure to be applied. The pressure may be applied by a hydraulic press or testing machine, and the cylinder may then be enclosed in a bath, so that the reaction may be studied under different temperatures. In one form of cylinder employed (Fig. 2), the pressure can be secured and continued by the screw, after removal from the press, where it has been applied in the usual manner.—A. C. W.

Fig. 1.

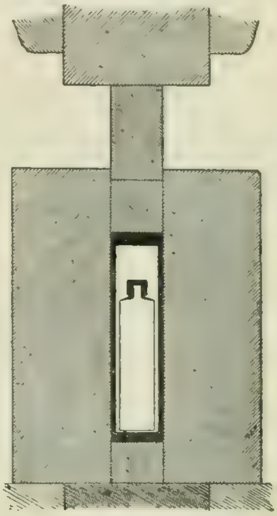
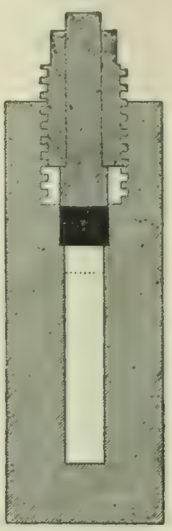


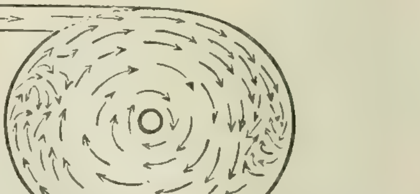
Fig. 2.



Gases and Liquids, Apparatus for the Mixing of. **T. Meyer. Chem. Zeit. 1899, 23, [53], 567.**

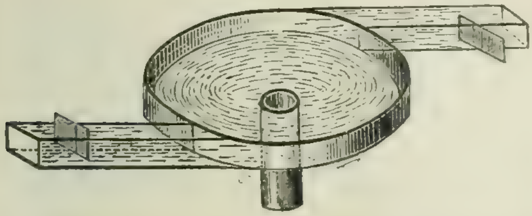
The author describes a mixing apparatus based on the following principles. If different fluids of the same specific gravity enter with equal velocity through tangential inlets, of the same size, at different points of the periphery, a circular basin, provided in the centre with an outlet tube, thes fluids mix uniformly with one another on their spira course to the central outlet. If, however, the fluids are o

Fig. 1.



different specific gravities, a uniform mixing does not take place. To attain uniform mixing of fluids of different specific gravities, a slight modification of the apparatus is necessary, *i.e.*, a slightly oval basin in place of a circular one. By this means, eddies are formed in the currents at the two narrow sides of the basin (see Fig. 1), and mixing ensues, even with fluids of different specific gravities, if the difference be not too great.

Fig. 2.



The essential features of a mixing apparatus constructed on this principle, and intended more especially for gases, are represented in Fig. 2. The height of the reservoir must be exactly equal to that of the inlet tubes, so that the motion is uniform throughout the apparatus. The velocity of the gases entering the apparatus may be regulated by slides, &c., introduced into the inlet tubes, and thus a gaseous mixture of definite composition may be prepared; but the slides must be introduced on the side inclined towards the apparatus, as otherwise the ingress of the gases would not be in a tangential direction.

The apparatus can be arranged for the mixing together of more than two gases, by introducing a corresponding number of tangential inlets distributed as uniformly as possible round the periphery; and it can be constructed, as desired, of glass, iron, stoneware, or other materials.—A. S.

Iron [*Ice Machines*], *Action of Liquid Sulphurous Acid on.* A. Lange. Woch. für Brau. 1899, **16**, [27], 357.

See under VII., *page* 759.

PATENTS.

Specific Gravity Estimating Apparatus for Gases, especially applicable as an Ozonometer; An Improved. M. Otto, Neuilly-sur-Seine, France. Eng. Pat. 17,525, Aug. 13, 1898.

The apparatus is designed to indicate and register the proportional quantity of ozone in a gaseous mixture. Two receivers of identical volume are suspended from the arms of a balance beam, which is normally supported by a fork. One of the receivers is closed, and carries a movable style opposite a recording cylinder, driven by clockwork, which automatically controls the apparatus. The second receiver is provided at its lower part with inlet and outlet valves for the gaseous mixture, the valves being automatically opened and closed, synchronously with the movements of the balance beam, which is controlled by cams actuated by clockwork. The gas-admission and exhaust cocks, which open communication with the valves of the second receiver, are mounted on the cam spindle. When the second receiver is charged, the balance beam is released from its support, and, after equipoise has been established, the style is operated by the clockwork to record the indication.
—R. A.

Filter Presses, Impts. in. J. C. Montgomerie, Ayrshire, N.B. Eng. Pat. 18,442, Aug. 27, 1898.

In a filter press having the feeding channel at the top, the internal side of the filter frame is formed with surfaces which incline downwards and outwards from the feeding orifice, to ensure the complete filling of the space to be occupied by the filtering material. The inlet to the frame is also formed with two diverging mouths or branches, to effect the lateral spreading of the supply and the complete charging of the upper portion of the frame.—R. A.

Filter Presses and similar Filtering Apparatus, Impts. in and relating to. J. Wilson, Glasgow. Eng. Pat. 18,074, Aug. 23, 1898.

The filter cloth, which may be in the form of an endless band or otherwise, is carried by rollers mounted on the upper ends of the filter frames and on the lower ends of the filter plates. The cloth is cleaned during the suspension of filtration, by causing it to travel through the press in contact with a series of revolving brushes, which are rotated in the opposite direction to the travel of the cloth. Scrapers may be employed in addition to, or instead of, the brushes, and water or steam jets may be projected on the cloth to facilitate the removal of the deposit. There is also claimed "in a filter press, the combination of a hydraulic cylinder in the back frame with a swinging screw for the proper closing up and withdrawal of the sections of the plates and frames."—R. A.

Filter-material, A New Process of and Means for Cleaning. A. Dervaux, Brussels. Eng. Pat. 21,274, Oct. 10, 1898.

The increasing resistance to the flow of the unfiltered water, caused by the accumulation of the impurities retained in the filter, is employed to raise a column of the unfiltered water to such a height that it automatically starts a siphon, which draws the cleansing water in the reverse direction through the filter. The action of the siphon is automatically stopped before the impurities are entirely removed from the filter material.—R. A.

Hydrocarbon and other Liquids, Improved Means for Storing. J. Smith, Penge, Surrey. Eng. Pat. 24,114, Nov. 15, 1898.

See under III., *page* 750.

Liquefaction of Aeriform Fluids, Impts. in Apparatus for the. O. P. Ostergren and M. Burger, New York, U.S.A. Eng. Pat. 26,361, Dec. 13, 1898.

The air or gas is cooled and compressed by suitable means or apparatus, and is then introduced into a condenser, which has two concentric spiral channels, one a gradually contracted channel for the incoming air, and the other a gradually expanded channel connected to it at the centre of the apparatus, so that the air from the first expands into the second. The air may be liquefied in an intermediate channel between the two spiral channels, or a portion of the air in the expanding channel may be directly liquefied. The liquefied air is drawn off from the centre of the apparatus through a suitable valve nozzle. The details of the apparatus, and modifications in the construction and arrangement thereof, are fully described.—R. A.

Kiln and Drying Oven, A Combined. H. F. J. Weijers, Udenhout, Netherlands. Eng. Pat. 4831, March 4, 1899.

The combined kiln and drying oven, say, for use in a brickfield, consists of a double parallel row of kiln chambers, between which, and on the same level, is the drying chamber. The flames pass through the kiln chambers from one to another, as is usual, the gases finally passing along a smoke flue, arranged immediately beneath and in a line with the drying oven, to the uptake. Each kiln chamber has an opening direct to the outside. The hot gases from kiln chambers which have been in operation are caused to pass out of these chambers, cold air entering through the above-mentioned orifices to cool the burnt material, and then pass through a connecting pipe to the upper portion of the drying chamber, which is separated from the main portion by a corrugated sheet-metal or like arch. At the end of the drying chamber the arch terminates, and the gases descend and pass backwards through the main passage of the drying chamber to the chimney.—R. S.

Liquid Gases [*Air, &c.*], *Improved Means for Conserving and Dissipating.* G. C. Dymond, Liverpool. From J. F. Brady, Chicago, U.S.A. Eng. Pat. 6039, March 20, 1899.

The liquefied gas is contained in a spherical chamber, which is surrounded concentrically by a series of other chambers. The chambers are preferably made of, or coated with, a good non-conductor of heat, and are provided with spring-controlled valves, &c., through which communication is established between the spaces enclosed by the chambers. The liquid introduced into the inner chamber is slowly dissipated into the surrounding chamber, until the pressure in the latter is sufficient to open its valve, when the gas enters the next succeeding chamber, and so on, the gas being utilised for refrigerating or other purposes as it is discharged from the valve orifice of the outer chamber. The pressure of the gas is reduced in its passage outwards from chamber to chamber, whilst its backward or counter pressure in the interspaces, serves to partially relieve the greater pressure of the gas on the inner chambers.—R. A.

Engine Packing, the Manufacture of Dynamite, and other Purposes; An Improved Material suitable for, and Methods of Preparing and Treating Same. P. M. Justice, London. From The Marsden Company, Philadelphia, U.S.A. Eng. Pat. 6656, March 28, 1899.

See under V., *page* 756.

Drying, Calcining, or Roasting Organic and Inorganic Substances [Sewage Sludge, &c.], Apparatus for. J. McCulloch, Glasgow. Eng. Pat. 8198, April 19, 1899.

The apparatus consists of a rotating cylinder slightly inclined to the horizontal, and an inner tube, which is arranged to convey the heated air from the higher or receiving end of the apparatus to a point near to the lower or discharging end, the air returning through the annular space between the cylinder and tube to the inlet end. The material is agitated within the annular space by means of louvres fixed to the cylinder and tube.—R. A.

Gases under Pressure [Motive Power], Impts. in Apparatus for Generating. H. M. Williams, Indiana, U.S.A. Eng. Pat. 9194, May 2, 1899.

See under II., *page* 745.

Syphons for Drawing off Molten Metals [Copper, &c.], Acids, and the like; Impts. in. R. G. Collins, Dollar Bay, Michigan, U.S.A. Eng. Pat. 9968, May 11, 1899.

The siphon tube is temporarily sealed by a disc of fusible metal, &c. at each end, and the air between the seals is exhausted, the seals being preferably of such a nature that they are dissolved or otherwise removed by the action of the liquid to be conveyed, so that the flow is automatically started by immersing the shorter end in the liquid. For conveying molten copper, &c., the tube may be of iron, and lined with a layer of the metal conveyed. This lining layer may be formed by checking the flow of the molten metal through the tube, by means of an adjustable valve at the outlet end. The shorter end may also be protected by a cylindrical shield of graphite or other refractory material. When used in conjunction with a furnace, the siphon and the furnace door are both adjustably suspended from pulleys by counterweighted chains, &c., the door having an opening through which the end of the siphon is inserted.
—R. A.

Mills, Mixing and Grinding, for the Manufacture of White Lead, Paints, and other Substances; Impts. relating to. T. and J. R. Torrance, Bitton, Gloucestershire. Eng. Pat. 10,107, May 13, 1899.

This apparatus, already partly described in Eng. Pat. 6263, 1890, consists of an improved form of edge-runner worked in conjunction with one or more three-roller mills. The pan of the former is stationary, the edge-runner revolving; and above it, concentrically with the driving spindle, is placed a hopper to contain the dry colour. Round the hopper is a vessel to hold the oil, whence a pipe descends into the trough of the mixer, surrounded by the shoot for the passage of the pigment. This arrangement revolves with, and opposite to the edge-runner, so that the colour is fed evenly into the pan, whilst it is moistened with oil before it has time to rise as dust. From the mixer, a conveyor leads the paste to a (granite or other) three-roller mill, or to two such mills in succession, in which the material travels upwards, and in which it is finished as usual.
—F. H. L.

Liquefied Gases, Impts. in Receptacles for Holding and Storing Liquids, more particularly Liquid Air or other. O. P. Ostergren, New York, U.S.A. Eng. Pat. 10,883, May 24, 1899.

The vessel containing the liquid is surrounded by a porous casing, of such a size as to leave a space between it and the vessel. The vessel and casing have each an inlet and discharge orifice, provided with a valve, which serves as a check valve for the liquid-containing vessel, and, when unscrewed, as a discharge valve. The casing may be surrounded with an enveloping sheath, provided with a blow-off valve, which is adapted to open at a predetermined pressure. The vapour given off from the liquid, passes through the check valve into the space between the vessel and the casing, where it acts as a jacket to prevent the conduction of heat from the exterior. An additional sheathing or jacket, which may be silvered or polished, may surround the sheath already referred to, and the air in the interspace between these sheaths may be exhausted. A delivery nozzle is provided, which can be inserted in the discharge orifice after removing the valve therefrom.
—R. A.

Separators, Impt. in Centrifugal. L. Herlitschka, Düsseldorf. Eng. Pat. 10,885, May 24, 1899.

The separator has an annular drum containing a helical guiding surface, each thread or element of which is inclined upwards from the circumference towards the axis of the drum. The guiding surface is so arranged that the liquid admitted to the drum is compelled to pass over the said surface on its way from the bottom to the top, or from the top to the bottom of the drum, the heavier liquid separating towards its circumference, and the lighter liquid separating towards its centre.—R. A.

Expressing Liquids from Solids [Cotton Seed, &c.], Impts. in Apparatus for. L. Baggett, Jackson, Mississippi, U.S.A. Eng. Pat. 11,771, June 6, 1899.

This apparatus comprises means for effecting the following objects:—First, placing the filter cloth in the press-boxes and charging the boxes with the material to be acted upon, thereby dispensing with the necessity for the use of separate means for forming the material into cakes or blocks prior to charging it into the presses; second, charging the boxes so that cakes of uniform density will be obtained; third, automatically closing the sides of horizontal, or the tops of vertical presses, and preventing the cloth or material from creeping when the pressure is applied; fourth, charging two or more presses by a single charging apparatus, which is adapted for being readily shifted from one press to another; and, fifth, ejecting the cakes of material from the press box after the liquid has been expressed, stripping the filter cloth from them, and delivering them to a suitable place.—R. A.

II.—FUEL, GAS, AND LIGHT.

Coal and Ambrite, New Zealand; Results of the Analysis of Samples of, and of Barbados Manjak. P. P. Bedson. Trans. North of England Inst. of Mining and Mech. Eng. 1899, **48**, [3], 82—87.

New Zealand Coal.—The proximate analysis gave:—

	Per Cent.
Moisture	4·66
Ash	1·10
Volatile hydrocarbons	47·80
Fixed carbon	46·44
Sulphur	0·54

The coal gives a non-coherent sandy coke. The ash is light in colour and consists chiefly of alumina and silica. The results of the estimation of the carbon and hydrogen, expressed in terms of the dried coal free from ash, are:—

	Per Cent.
Carbon	74·32
Hydrogen	5·67
Oxygen and nitrogen	20·01

This coal therefore appears to be most nearly related to the "dry coals burning with long flame" of Grüner's classification.

Ambrite.—Brown transparent resin found in association with the coal. Contains 0·59 per cent. of moisture and 0·18 per cent. of ash. The estimation of the carbon and hydrogen gave—

	Per Cent.
Carbon	80·95
Hydrogen	9·87
Oxygen	9·18

It resembles very nearly in composition a resinous body met with in association with coal and described by Stanek as *reussinite.*

Barbados Manjak.—The proximate analysis gave:—

	Per Cent.
Ash	1·58
Fixed carbon	36·52
Volatile matter	61·90

It leaves a coke which is much larger in volume than the manjak. Ultimate analysis gave:—

	Per Cent.
Carbon	81·18
Hydrogen	8·43
Oxygen	10·39

Manjak in appearance closely resembles *albertite* which, however, contains a larger proportion of carbon and hydrogen. They differ materially in their behaviour with pyridine, *manjak* being completely soluble therein, whilst *albertite* is only slightly soluble, giving a yellowish solution with a slight green fluorescence.

In connection with the great solvent power of pyridine, the author mentions that neither cold nor hot pyridine dissolves any portion of anthracite coal, whilst from Durham coal from 16 to 18 per cent. was dissolved, and in the case of New Zealand coal from 10 to 13 per cent.

—D. B.

Smoke and its Diminution. Bryan Donkin. Engineer, 1899, May 26, 507; June 2, 531; June 30, 637. (See also President's Address, this Journal, 1899, 643, col. 2.)

After discussing the different sources of origin of smoke, and the causes that lead to its production, the author reviews the methods which have been proposed for the determination of its amount and density.

Fritsch proposed to draw off and measure the gases of combustion from a chimney or flue through a glass tube of known diameter, and then pass a given quantity through cellulose in order to retain the soot. The cellulose and soot are then placed in a bottle with a definite quantity of water and shaken up. A scale is previously prepared by mixing the same quantity of water with 2 grms. of cellulose containing quantities of soot varying from 5 to 30 mgrms. The different shades thus obtained, painted on paper, are affixed to the bottles in which the soot tests are made. The method is simple and has the advantage of furnishing a definite smoke scale.

The author has carried out smoke tests with a large number of different scales with the number of shades of intensity varying from 10 to 3. He considers that the best scale to adopt is that with five shades, such as is used in Switzerland and Germany.

The Ringelmann smoke scale is recommended as the best yet produced. In this scale the different greys into which the shades of smoke are naturally divided are represented by black cross lines on white paper; thus:—

No. 0.—No smoke. All white.

No. 1.—Light grey smoke. Black lines, 1 mm. thick and white spaces of 9 mm. between.

No. 2.—Darker grey smoke. Black lines, 2·3 mm. thick, 7·7 mm. apart.

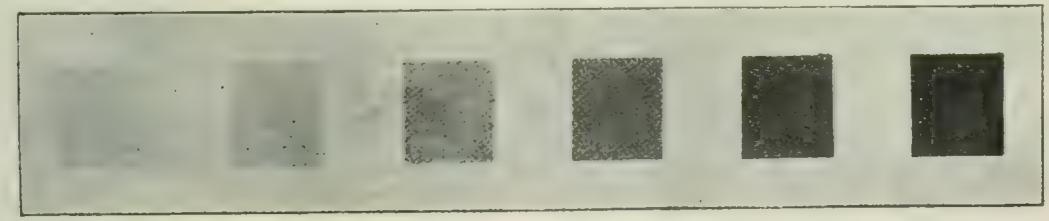
No. 3.—Very dark grey smoke. Black lines, 3·7 mm. thick, 6·3 mm. apart.

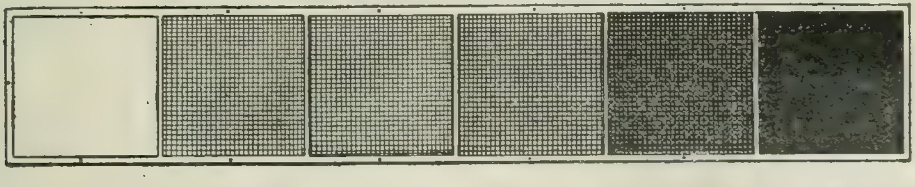
No. 4.—Black smoke. Black lines, 5·5 mm. thick, 4·5 mm. apart.

No. 5.—Very black smoke. All black.

The diagrams should be hung up in such a way, and at such a distance (say 80—100 ft.) from the observer, that he can see both them and the top of the chimney under inspection at the same moment, and in the same line of sight; and a second observer, when the first is testing the smoke from a given chimney, should add particulars as to the time and method of stoking, &c. The data obtained should be plotted on paper on a time basis, and if the observations be taken every minute during a day of, say, eight hours, the whole process is exhibited graphically. (See smoke diagrams.)

The five degrees of the smoke scale are represented in the two figures given. In the one, as seen near at hand, the cross lines are clearly shown, whilst the other, as seen at a distance, represents their effect in different shades of grey to black.





Diminution of Smoke.—In considering the question of the diminution of smoke, it is important to note that it is easier to check the formation of smoke than to get rid of it when it is already formed. Soot may perhaps be brought to a red heat, but it cannot be completely burnt, because as the flame cools, a fresh separation takes place, and the carbon is again deposited as soot. To remedy the smoke nuisance, combustion must in some way be improved—that is to say, the temperature of combustion must be so maintained that more carbon is consumed, and less, or, properly speaking, none, escapes up the chimney. A group of German experts agree that to attain perfect combustion, the hydrocarbons generated by the decomposition of the carbon and hydrogen in the fuel, must be brought rapidly to a very high temperature before they are allowed to escape; they must, during this process, be supplied with sufficient air to maintain combustion, and this air must be admitted in such a way that it becomes thoroughly mixed with the gases before they pass off.

Spence has made a series of experiments on the question of the admission of air to a boiler grate, and its effect on the smoke produced. Varying supplies of air were allowed to enter both above and below the fire bridge and also over the fire door, thus coming into immediate contact with the top of the fire. It was found that, up to a certain limit, the more air that was admitted in this way, the less smoke was produced, until at last none was observed from the top of the chimney. An arrangement with which scarcely any smoke is said to be produced, is at work in Sheffield, in which air is admitted automatically to the back of the furnace every time the charging doors are open for stoking.

There are difficulties in the way of most of the methods of stimulating combustion by heating the air before it passes to the grate, and the cost is not always counterbalanced by the gain.

In diminishing or preventing smoke, flues and chimneys should be kept clean. In stoking a boiler grate by hand, it is best to supply the coal either on the "coking" or the alternate system. In the first, the coal is fed on to the front of the grate, and gradually pushed back as combustion proceeds; in the second, it is fed first to one side, then to the other of the fire. With both these methods, part of the fire is always in a state of incandescence, and the fresh coal is never fed directly over the whole in a thick layer, thus checking combustion. As a rule, less smoke is produced with mechanical stokers than when the grates are fired by hand.

For boiler furnaces, two methods have already been used to a certain extent. The first is the American system of down draught furnaces, in which there are two grates, one above the other. Combustion is started on the upper grate, and when it is nearly completed, the fuel is raked down on to the lower grate, where the coal is completely converted into coke. The air for combustion is admitted only at the top, and is drawn down through the glowing fuel, combustion taking place downwards instead of upwards as usual. There is said to be little or no smoke with these furnaces, but they are rather complicated, and several parts are apt to get out of order. The other system is that of firing with powdered coal, which is introduced together with a quantity of air calculated so as to ensure complete combustion. A good draught is required.

Under a boiler, gas firing not only secures absence of smoke, but also economy of fuel.

In the report of the English Smoke Abatement Commission of 1895, it is stated that a great deal might be done, especially in boiler furnaces, by careful stoking, and the use of mechanical stokers.

The German Smoke Commission of 1894, examined a number of grates used in Germany. In most cases the grates were inclined, sometimes at a steep angle, and the air for combustion was introduced horizontally between the fire-bars at a certain angle to the grate. The report stated that a large number of steam boiler grates already exist, which may be so worked that the products of combustion escaping from the chimney are neither troublesome to the neighbourhood nor injurious to health. It is also stated that experience has shown that it is more economical to have a fire burning with a little rather than with no smoke; and stress is laid on the fact that the best arrangements for smoke abatement are useless, unless they are continually supervised to keep them up to the mark.

In the report of a committee of experts appointed in St. Louis, U.S.A., in 1891, the following means for the prevention of smoke are described: Gaseous fuel, steam jets, fire-brick arches and "checker work," hollow walls for heating the air for combustion, coking arches or chambers, double combustion furnaces, and automatic stokers. It is stated that all these have proved more or less effective in diminishing smoke, their effectiveness depending largely on the skill with which they are operated, but none are entirely satisfactory.

The *Verein Deutscher Ingenieure*, sums up the requisites for good combustion as follows:—(1.) The grate must be suited to the kind of fuel burnt and to the working conditions, or else coke or anthracite, which under given circumstances burn without smoke, must be used. (2.) Practical uniformity in the quantity of fuel burnt at one time. (3.) Sufficient draught. (4.) Careful and skilful stoking. (5.) A chimney high enough to carry off the products of combustion. Smoke consuming apparatus, even if carefully erected, frequently fail because the fuel is improperly stoked, and is supplied in irregular or excessive quantities. In order to utilise to the utmost the heat supplied, and make it respond to large, though not sudden variations in combustion, boiler grates should be made to vary in size by a movable fire-bridge or other arrangement, and should have large water spaces to store up the heat. The layer of fuel should never be allowed to burn down too low, for by heaping large quantities of fresh fuel on the grate at a time, smoke is produced.

The Paris Commission of 1894 reported that an ordinary grate, if carefully stoked with fairly good coal, may be made to emit much less smoke than it generally does. The amount of carbon carried off in the smoke as soot is too small to cause waste in the fuel, although it may vitiate the air to a large extent. That economy of fuel and smokelessness do not necessarily go together was definitely settled by noting the evaporative power of the boiler at the same time as the smoke from the chimney. The apparatus which produced the least smoke did not give the highest evaporation.

The numerous smoke abatement devices may be briefly classified as follows:—

A. Mechanical stokers. These effect a material saving in the labour of firing, and are efficient smoke preventers when not pushed beyond their capacity, and when the coal does not coke badly. They are rarely able to respond to sudden changes in the rate of firing such as frequently occur in practice.

B. Air flues in side walls, bridge wall, and grate bars, through which air for combustion passes. The results are always beneficial, but the flues are difficult to keep clean and in order.

C. Coking arches, or spaces in front of the furnace, arched over, in which the fresh coal is coked, both to prevent cooling of the distilled gases and to force them to pass through the hottest part of the furnace, just beyond the arch. The results are good for normal conditions but not when the fires are forced. The arches, also, are easily burned out, and injured by working the fire.

D. Dead plates, or a portion of the grate next the furnace doors, reserved for warming and coking the coal before it is spread over the grate. This arrangement which embodies the method of "coke firing" previously described, gives good results when the furnace is not forced above its normal capacity.

E. Down-draught furnaces. These give good results.

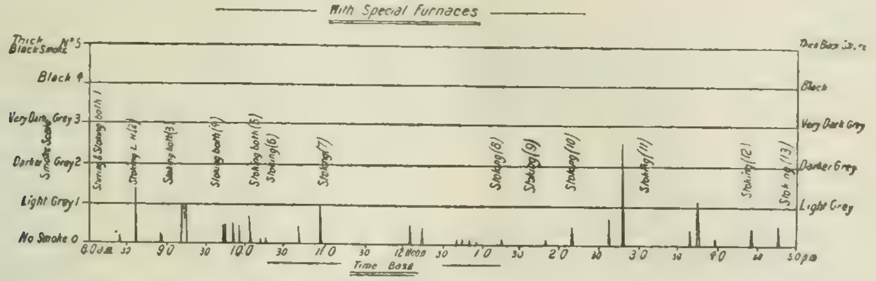
F. Steam jets, to draw air in or inject air into the furnace above the grate, and also to mix the air and combustible gases together. This method is very effective, but is liable to waste fuel and steam by introducing too rapid a draught.

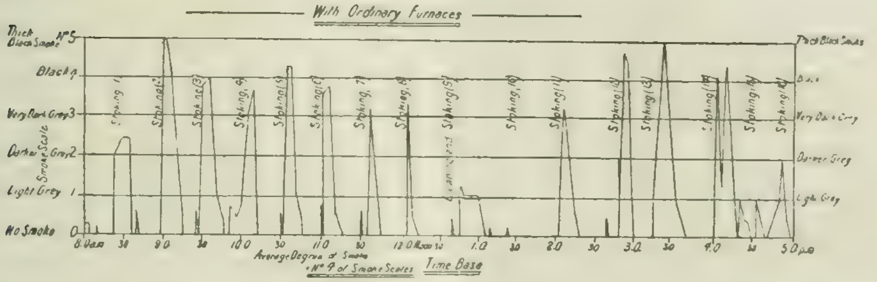
G. Baffle plates placed in the furnace above the fire to aid in mixing the combustible gases with the air.

H. Double furnaces, of which there are two different types; in the first, the second grate is placed below the first—the coal is coked on the first grate, and the distilled gases are made to pass over the second grate, where they are ignited and burned; the coke from the first grate is dropped on to the second grate—a very efficient and economical smoke preventer, but rather complicated to construct and maintain. In the second type, the products of combustion from the first furnace pass through the grate and fire of the second, each furnace being charged with fresh fuel when needed, the latter generally with a smokeless coal or coke—an irrational and unpromising method.

The author, in conclusion, states that the different kinds of English coal vary very much as regards yielding smoke. The sizes of the pieces of coal also affect the amount of smoke. Dust and pieces about $\frac{1}{16}$ in.– $\frac{1}{8}$ in. give, as a rule, more smoke and dirt than larger coal or pieces of 2 in.—4 in. He considers that windows or openings should be provided, to enable the stokers to watch the top of the chimney at all times, and to see for themselves how much or how little smoke they make.

In testing an apparatus for diminishing smoke, a proper eight hours test should be made, working both with and without the apparatus. All the coal should be weighed, and the water which is evaporated should be measured. The best practical method of carrying out the test is to plot on paper, on a time basis (say, every minute), the actual degree of smoke seen coming from the chimney, as described in the first part of the paper. The author quite agrees with other authorities that, with reasonable care and attention, black smoke, No. 4 or No. 5 (see Smoke Scales) can be very largely diminished, if not altogether prevented. Fairly good fuel should be burnt, and combustion not forced.





As an example showing to what extent smoke can be diminished, a figure is given of observations taken every two minutes during two trials on the same Lancashire boiler. In both series of tests all the conditions were the same, and only the grate or furnace was changed. The same smoky coal, carefully mixed, was burnt. The zigzag line denotes the marked difference in combustion between the ordinary and a special furnace. (See Smoke Diagrams.)—A. S.

Smoke Consumption and Economy of Fuel. U. S. Cons. Reps., July 1899, 491.

The process of Paul Cornelius is here referred to for the consumption of low-grade fuels, patent No. 100,437 German, and No. 613,359 United States Patent, although the practical process has been improved since the original patents were issued.

The process consists in distributing heated and slightly compressed air through hollow grate bars to the whole lower surface of the furnace, which, being injected upwards through the mass of burning fuel, secures equal and perfect combustion and an intense regular heat from materials that would not be available if burned by ordinary methods. This system has been in practical use since September last at the works of Messrs. Reissner, Wahl, and Co., at Guben, and since December last at a large hotel in Berlin, where a steam-engine supplied by two boilers, is kept to drive a dynamo.

In the Berlin installation, two boilers, of the ordinary flue pattern, are placed side by side, and their furnaces are separated by a dividing wall, so that one can be thrown out of use or turned on as occasion may require. The furnaces are about 10 ft. by 4 ft. in area, and the smoke passes, by subterranean flues, to a chimney stack standing in a central court, and rising above the roof of the building. Near the furnaces is located an ordinary fan blower, driven by an electrical motor of one-half horsepower, the speed of which is easily controlled, and which drives the air through a 6-in. pipe into a hollow iron chamber about 10 ins. deep, forming the front section of the hearth of the furnaces. Into this air chamber is fitted one end of the hollow grate bars. They are about 2½ ins. in diameter, extend backward the length of the furnace, and are supported by ordinary bearings at the farther end. These hollow grate bars are round on the bottom, but hexagonal at the top, presenting three faces, each pierced with holes about 2 ins. apart, and beginning with a calibre of $\frac{1}{8}$ in. which increases slightly throughout the length of the bar, to equalise the discharge of air from the gradually decreasing pressure within. The hollow grate bars are laid about 6 ins. apart, and there are placed between each pair three solid triangular bars, which assist in sustaining the weight of the burning fuel. The air forced by the fan blower into the hollow chamber, is there heated from the upper surface of the fire, subsequently passing into the hollow grate bars, and being injected upwards in three rows of jets, one vertical and two inclined to right and left, so that the entire under surface of the burning mass resting on the grate is fed constantly by jets of freshly-heated air. Thus, from the most ordinary grades of fuel an intense white heat is generated. This can be perfectly controlled by regulating the speed of the fan blower, and a combustion so perfect is produced that the smoke is entirely consumed.

The fuel in use was coke dust, the fine slack that comes from screening gas coke, the scrapings of retorts, &c., which have hitherto been regarded as worthless except for ballasting roads and footpaths. The bed of burning fuel was maintained over the surface of the grate about 5 ins. deep, and the fire was white, intense, and evenly distributed. The air current being stopped, the fire at once assumed a reddish tinge, and began to smoke.

In Cornelius' original invention, reinforcing the combustion by impregnating the injected air with a small proportion of cheap oil gas was contemplated; but experience soon proved that pure heated air was quite sufficient, and, further, that the air chamber, instead of being located at the front end of the furnace, should be at the rear where the heat is most intense, and whence the current in the grate bars is injected forwards—that is, in a direction opposite to the draft of the furnace itself. The hollow grate bars are of cast iron, made in sections about 3 ft. in length, with pierced flanges, which enable them to be bolted together at the ends, so that the bar may be lengthened to fit any furnace. Being protected by the current of air, the bars are practically indestructible by fire; those in use since September being still in good condition.

The advantages which seem to have been secured by this system may be summarised as follows :--

(1.) The smokeless consumption of bituminous slack and other waste of mines and coke works in cities and towns.

(2.) The use, for steam and heating purposes, of the lowest grades of bituminous coals, peat, sawdust, and anthracite waste.

(3.) In naval vessels, notably torpedo boats, the securing of such complete consumption of bituminous fuel as to eliminate smoke.

It will be understood that whilst any fuel—lump or nut coal for instance--burns fiercely on a Cornelius grate, perfect combustion, with consumption of smoke gases, require that the fuel be pulverised, so that for naval purposes lump coal would have to be crushed in order to secure the best results.

Smoke Fumes, Identification of Damage by. H. Ost and C. Wehmer. Chem. Ind. **22**, [11], 233—237.

THE authors examined certain violet patches occurring on rose leaves in and near Hanover, and ascertained that the special pigment formed therein is developed in the sap of the epidermal and parenchyma cells on the upper side of the leaf, but is independent of the chlorophyll, being found in the chlorophyll-free epidermis cells as well as in the under cells containing that colouring matter. Alkalis turn this violet pigment to a bluish-green, acid restoring the red violet shade; aqueous sulphurous acid produces gradual decolorisation, an effect neutralised by sulphuric acid or prolonged exposure to the air. Although the position of the patches and their manner of extension point to external influences as the exciting cause, the nature of these influences could not be definitely ascertained.

In the authors' opinion, the damage done to vegetation by smoke fumes has been exaggerated, since, although the presence of sulphur dioxide from neighbouring factory chimneys is frequently apparent in the garden attached to the Technical High School in Hanover, no appreciable injury has resulted to the plants there.—C. S.

Carbon Monoxide, Decomposition of, in Presence of Metallic Oxides. O. Boudouard. Comptes Rend. **128**, [25], 1522—1523.

THE author has continued his previous experiments (this Journal, 1899, 498), at a temperature of 800° C., using a porcelain tube instead of glass. Whether the oxide used be cobalt, nickel, or iron, the gas is decomposed, the amount of carbon dioxide formed increasing with the time, and reaching a limit at about 7 per cent. The rapidity of reaction is greater at this temperature than at 650° C.—J. T. D.

Carbon Dioxide, Decomposition of, in Presence of Carbon. O. Boudouard. Comptes Rend. **128**, [25], 1524—1525.

ON heating carbon dioxide to 800° C. with carbon, either in the form of wood charcoal, retort carbon, coke, or carbon reduced from the monoxide, a limit to the reduction is reached, much more slowly in the case of retort carbon than to any of the other varieties. This limit, corresponding with about 7 per cent. of dioxide and 93 of monoxide, is the same as that reached when the monoxide is heated with metallic oxides (see preceding abstract.)—J. T. D.

Naphthalene Deposits [in Gas Plant] : their Cause and Prevention. J. P. Leather. J. Gas Lighting, **73**, 1899, 1734—1736.

REFERRING to W. Irwin's tables showing the amounts of condensable products in the gas from one ton of coal, and of the vapour tensions of hydrocarbons (this Journal, 1899, 109), the author concludes from these and similar figures obtained from analyses of Burnley gas, that at 60° F. only about 25 per cent. of coal gas is saturated with hydrocarbons other than naphthalene, but that the naphthalene present is little short of the quantity which would saturate the whole of the gas. Hence, when the gas is subjected to a lower temperature, the naphthalene is first deposited in the largest quantity, and being a voluminous solid at ordinary temperatures, it occupies much space and obstructs the mains, &c. If the quantities of other hydrocarbons, such as cumene and xylene, present in the gas, were greater than they are, these hydrocarbons would be simultaneously condensed in sufficient amount to dissolve the naphthalene and carry it to the nearest siphon. But at the high temperatures of carbonisation which now prevail in gas works, the quantity of these hydrocarbons in the gas is too small, and other means must be found for removing the naphthalene. The means adopted may depend on one or both of the following courses :—(1) Prevention of deposition by the withdrawal of naphthalene from the gas, so that the gas will not be saturated at the lowest probable temperature. (2) Addition to the gas of some material which will bring the naphthalene, when deposited, into the liquid state.

Washing may be adopted with a liquid which will dissolve the naphthalene and remove it from the gas. The author has used creosote oil in an ordinary scrubber and has found that it absorbs about 16 per cent. of its weight of naphthalene. It also absorbs about 6 per cent. of benzol, but if this proportion be added to the oil before use, the amount of benzol in the gas remains unaffected. It was found that 200 galls. of creosote oil dissolved the naphthalene present in 10,000,000 cb. ft. of gas. No naphthalene deposits were observed in the distributing system until the oil used in the scrubber had become saturated with naphthalene. Messrs. Botley charge gas as it leaves the works with a fine mist of paraffin oil, of which about 45 per cent. appears to be retained by the gas, and the remainder is deposited in the mains along with 40 per cent. of hydrocarbons absorbed from the gas. The author found that the deposited oil contained 5 per cent. by weight of naphthalene, corresponding to about one-fifth of the naphthalene in the gas, whilst the benzol carried down by the oil amounted to less than $\frac{1}{1400}$ of the benzol present there. The removal of one-fifth of the naphthalene prevents deposits under ordinary circumstances, but if the temperature were exceptionally low, the oil mist retained by the gas would reduce any deposit of naphthalene to the liquid state.—J. A. B.

Naphthalene Question (Naphthalene Deposits in Gas Plant). [*Corrigendum.*] P. Eitner. J. für Gasbeleucht. 1899, **42**, [26], 425.

THE author points out that in his former communication on this subject (this Journal, 1899, 356) the price of solvent naphtha, or crude xylene, was taken at 10 marks per 100 kilos., whereas it is actually about 30 marks. The cost of preventing naphthalene deposits by the use of that material is, therefore, three times as great as was given in the former paper, but it remains $4\frac{1}{2}$ times as low as is the cost of alcohol for the purpose. Petroleum ether, benzene and toluene, if applied in sufficient quantity to gas to prevent naphthalene deposits, cause the flame of the gas to be very smoky. Solvent naphtha is, therefore, the most rational agent to employ, as was contended by the author in the aforementioned paper.—J. A. B.

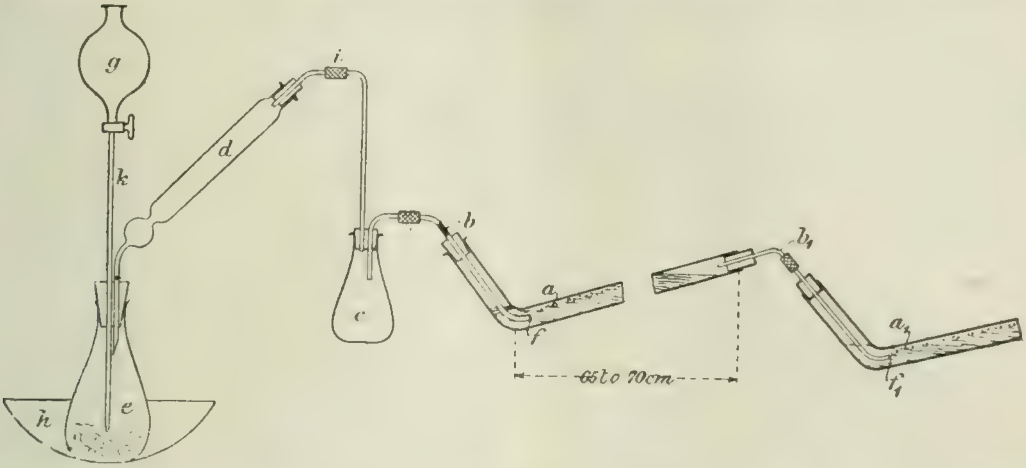
Calcium Carbide, Notes on the Manufacture of, and Analysis of Acetylene. G. Hanekop. Zeits. angew. Chem. 1899, [25], 592—595.

THE author has made determinations of the electrical conductivity of fused carbide, and finds that this varies between $\frac{1}{430}$ and $\frac{1}{630}$ of that of mercury. He found that the conductivity was lowest, near to the bottom electrode in the ordinary form of carbide furnace, and he attributes this to the lower temperature which exists at this point. A sketch of the apparatus used, and a tabular statement of the results, are given.

The use of wood charcoal in place of gas carbon, for carbide production, formed the subject of a second inquiry. The experience at a small carbide plant, which for $1\frac{1}{2}$ years has used the former, shows that 780 kilos. of wood charcoal will yield 1,000 kilos. of carbide, and that a mean output of 4·15 kilos. of carbide per E.H.P. day can be obtained. The author attributes this slightly higher yield to the greater ease with which wood charcoal can be converted into graphite. A second advantage is that the carbide produced is purer than that made from gas carbon.

The author also deals with the analysis of acetylene gas, and describes a simplified form of the apparatus devised by Lunge and Cederkreutz (this Journal, 1897, 1046). This is illustrated in the figure on next page.

It consists of a decomposing flask, *e*, in which the carbide is placed, a drying tube, *d*, a safety flask, *c*, and two absorbing tubes, *a*, and a_1, containing a solution of sodium hypochlorite. These tubes are 650–700 mm. in length, and 15 mm. wide. The ends are closed by perforated corks, through which glass tubes 3 mm. in diameter pass, as shown in the figure. At ff_1, these tubes are bent slightly upwards, and are partially closed by heating, in order to reduce the size of the gas bubbles. The leg of the funnel, *g*, must be 30 cm. long, and the funnel must hold 150 c.c. of water. This will suffice to decompose 50--55 grms. of carbide. The impurities of the gas are retained by the sodium hypochlorite solution; while the residue in the decomposing flask may be examined for iron silicide, and silicon carbide. If the decomposing flask and drying tube be weighed before and after the decomposition of the carbide, the loss of weight can be used to calculate the yield of acetylene gas, and purity of the carbide. 1 litre of acetylene at 0° C. and 760 mm. pressure, weighs 1·161 grms.



When using this apparatus, the decomposing flask *e* should be kept cool, by immersion in a basin of cold water, *h*.
—J. B. C. K.

Acetylene, The Purification of. F. Ullmann and I. Goldberg. J. für Gasbeleucht. 1899, **42**, [23], 374—377.

The merits of certain substances as purifying materials for acetylene were compared by making quantitative analyses of acetylene before and after passage through each material. A sample of crude acetylene was stored in a gasholder of 150 litres capacity, and the gas was passed, when needed for an experiment, into a holder of 30 litres capacity, which was provided with a scale on which the quantity of gas in the holder could be read with an error not exceeding 50 c.c. The tanks of the holders were filled with strong brine saturated with acetylene. The impurities in the gas in the large holder were determined by Lunge and Cederkreutz's method (Zeits. angew. Chem. 1897, 651; this Journal, 1897, 1046, and see previous abstract), which gave concordant results. A volume of the gas measured by the small holder was then passed through a tower containing the purifying material, and thence into the absorption bulbs for the determination of the impurities remaining in it.

The first material tried was 100 grms. of kieselguhr impregnated with 100 c.c. of 10 per cent. hydrochloric acid containing 30 grms. of ferric chloride. The amounts of sulphur and phosphorus in the crude acetylene were both unaffected by its passage through this material. The chromic acid purifying material recommended by one of the authors (Acetylen in Wissenschaft und Industrie, 1899, 28) was next tried in the same manner. The whole of the phosphorus and all but 3 per cent. of the sulphur in the gas were removed by this material. 100 grms. of kieselguhr which had absorbed 100 c.c. of Frank's cuprous chloride solution (Acetylen in Wissenschaft und Industrie, 1899, 9) were then tried, and were found to remove all the phosphorus from the gas, but to have no effect on the sulphur compounds. Chromic sulphate was finally tried in a similar manner, but was found to have no effect on either the phosphorus or sulphur compounds in the gas.

The amount of chromic acid in purifying material in which it is the active ingredient, may be determined volumetrically by extracting the mass with dilute solution of caustic soda, adding 10 per cent. solution of potassium iodide and 20 per cent. hydrochloric acid and a slight excess of sodium thiosulphate, and then titrating back the excess of thiosulphate with iodine. It was thus found that 1 grm. of the fresh material contained 0·0811 grm. of chromic acid. A titration of used material showed to what extent the chromic acid had been exhausted. It was thus shown that the material was not acted upon by previously purified acetylene, and that consequently the chromic acid did not attack the acetylene. Similarly, by passing known volumes of acetylene containing known amounts of phosphorus and sulphur compounds over the material, and afterwards titrating, it was demonstrated that the consumption of purifying material was intimately related to the quantity of the gas, and, further, was dependent on the amounts of the impurities in the latter. The effect of acetylene which had been passed through other purifying materials, on the chromic acid material was next observed, by titrating the latter before and after use. It was thus established that acetylene, purified by means of chloride of lime, was without action on the chromic acid material, and, consequently, that chloride of lime completely purified acetylene. Also that acetylene purified by means of cuprous chloride had a slight action on the chromic acid material, the extent to which the latter was acted upon corresponding to the proportion of sulphur compounds in the crude gas. Acetylene passed over ferric chloride, had the same action as the crude gas on the chromic acid material. These researches therefore show that ferric and chromic salts do not purify crude acetylene, that cuprous salts do so only partially, and that material containing chromic acid purifies the gas completely. Caro has used chromic acid under quite different conditions in experiments on acetylene, and he claims that he has demonstrated that the chromic acid material is not an efficient purifying agent. He did not use it under the prescribed conditions.—J. A. B.

Acetylene: Purification from Phosphuretted Hydrogen by Means of Alkali Chlorides. C. Goettig. Ber. 1899, **32**, [11], 1879.

The following methods have been in use hitherto for purifying acetylene gas:—(1.) Frank uses the solutions of acid metallic salts. (2.) Lunge and Cederkreutz, chloride of lime. (3.) Willgerodt, bromine. (4.) Bergé and Reychler employ mercuric chloride. (5.) Pictet, saline solutions and acids at a temperature below 10° C. (6.) Ullman, chromic acid in acetic- or sulphuric acid solution. In order to avoid the formation of explosive metallo-acetylene compounds, an excess of acid is necessary in nearly all these methods. The author has now found that the acid can be advantageously replaced by potassium or sodium chloride solutions, provided that they be mixed in certain definite proportions.

(*a.*) 100 grms. of ferric nitrate, 10 grms. of copper sulphate, 10 grms. of mercuric nitrate, 20 grms. of nitric acid (sp. gr. 1.2) and 1,000 grms. of water were mixed.

(*b.*) The same solution was made with the addition of 40 per cent. of a potassium chloride solution, containing 20 per cent. of KCl.

50 c.c. of each of these two solutions were placed in two wash bottles, crude acetylene gas being then passed through them into 20 c.c. of a solution containing mercuric chloride and hydrochloric acid (sp. gr. 1, 2), until a faint turbidity appeared. This occurred—

1. In four experiments, when solution "*a*" was used after passing through—

——	I.	II.	III.	IV.
c.c. of crude acetylene	600	650	550	600

2. Four experiments, solution "*b*."

——	I.	II.	III.	IV.
c.c. of the same gas............	2,400	2,500	2,700	2,800

Similar experiments were carried out without the use of nitric acid.

α. Solution "*a*" without nitric acid.

β. Solution "α" with potassium chloride.

Results :—

——	I.	II.	III.	IV.
	c.c.	c.c.	c.c.	c.c.
α	1,050	1,520	1,250	1,420
β	5,725	6,200	5,200	5,650

It is evident from these figures which are, of course, only of approximate accuracy, that the addition of KCl in place of acid to the above metallic salts solution, increases very considerably the capacity for decomposing phosphuretted hydrogen, at the same time preventing the formation of explosive mercuro-acetylene compounds.—S. K.

Luminosity of, Rare Earths, when Heated in vacuo by Means of Cathode Rays. A. A. Campbell Swinton. Proc. Royal Soc. 65, [415], 115—119.

The author has submitted "mantles" of thoria, ceria, and mixtures of these, to the bombardment of cathode rays in a form of Crookes' tube, in which two spherically concave discs of aluminium, 1·125 ins. in diameter, were arranged as electrodes, 7 ins. apart, and were connected to the secondary terminals of a 10-in. Ruhmkorff coil, the primary of which was supplied through a variable resistance with an alternating current at 100 volts. The "mantles" consisted of little plates, fully 0·2 in. thick, obtained by impregnating very closely woven purified cotton lamp-wick with the ammonium double nitrates, and then burning out the cotton. The radius of curvature of the electrodes was 6 ins., giving almost parallel beams of the cathode rays, and as the "mantles" were mounted midway between the electrodes, a considerable ring-shaped, hollow area on each side was subjected to the rays.

One theory to account for the brilliant incandescence of gas mantles, requires the assumption of catalytic or some other chemical action between the oxides and the constituents of the Bunsen flame. The author finds, however, that the intense heat produced at the focus of the cathode rays will produce a very high incandescence with the earths, at a sufficiently high degree of exhaustion, whether the small amount of residual gas consist of air, oxygen, or hydrogen.

With a "mantle" of asbestos, powdered over with pure thoria, it was found that at a suitable degree of exhaustion, the thoria became brilliantly incandescent with an intensity of cathode rays that made the asbestos barely red-hot.

A mantle was made in two sections, the one consisting of pure thoria, the other of a mixture of 99 parts of thoria and 1 part of ceria; the sections were impregnated separately and were then sewn together with impregnated cotton before being burnt. This was so mounted in the tube that the rays impinged upon equal areas of the two patches. It was found that, on starting the cathode discharge, the thoria *plus* ceria became incandescent more rapidly, and, on stopping the discharge, cooled more rapidly than the pure thoria. When at full glow, the mixture was slightly more luminous than the pure thoria, but probably not more than 5 per cent. brighter; whereas, as is well known, a mixture of that composition gives in the Bunsen flame many times as much light as is given by pure thoria. Owing to the difficulty of maintaining a constant vacuum, accurate photometric tests were not possible, but a rough estimate gave the illuminating power under favourable conditions as at least 150 candles per square inch of incandescent surface, at an expenditure of electrical energy in the secondary circuit, at about 8,000 volts, of about 1 watt per candle. The degree of exhaustion required varied, but was approximately 0·00005 atmosphere. After a short bombardment, the affected parts of the "mantle" were found to be discoloured, the pure thoria being dark blue, whilst the mixture was brown. This appears to be due to a deoxidising effect of the cathode rays, as on admitting a minute quantity of air to the tube during the discharge, the discoloration disappears instantly, and it also disappears in a day or two if air at ordinary pressure be admitted to the cold "mantle."

At a higher exhaustion than that which produced incandescence, the thoria fluoresced with a blue, the mixture with a yellowish light, the fluorescence being brighter if the oxides were first decolorised by a previous bombardment. With very high exhaustions the mixture fluoresced the more brightly; at lower exhaustions the pure thoria gave the brighter fluorescence.

A mantle was made up of four patches or sections, as follows :—1. Pure thoria. 2. Pure ceria. 3. 50 parts of thoria *plus* 50 parts of ceria. 4. 99 parts of thoria *plus* 1 part of ceria. With an intensity of rays which gave a brilliant light with sections 1 and 4, sections 2 and 3 gave practically no light, becoming barely red-hot; while, as before, the mixture 4 gave slightly more light than pure thoria gave, and heated up and cooled more rapidly than the latter. It is noteworthy that with a given intensity of bombardment the thoria should have given a brilliant light, whilst the ceria gave practically none; in the gas flame, thoria and ceria give just about the same poor amount of light.—H. B.

Blast-Furnace Gases, Power from. E. Disdier. Iron and Steel Inst. May Meeting, 1899.

See under X., *page* 767.

PATENTS.

Liquid Fuel Burners, Impts. in and relating to. P. Davies, Southfields, B. Woodcock, Cleckheaton, and E. Oddy, Cleckheaton. Eng. Pat. 6703, March 19, 1898.

The following represents the substance of the claims :— An apparatus for feeding liquid fuel to a combustion chamber comprises two concentric passages, the orifice of the inner one, which constitutes the hydrocarbon outlet, being in advance of the outer one, which constitutes the steam outlet. The hydrocarbon outlet has a flaring extremity, and the steam outlet has a nozzle provided with a central orifice, the walls of which taper towards the flaring extremity of the hydrocarbon outlet. The latter is regulated by an adjustable needle plug. The feeder is inserted into a furnace through a window having sliding doors, whereby the supply of air may be regulated. When the feeder is not in use, it may be protected from the heat of the combustion chamber by lowering in front of it a protecting plate or shield.—R. S.

Liquid Fuel Burners, Impts. relating to. P. Davies, Southfields, B. Woodcock, Cleckheaton, and E. Oddy, Cleckheaton. Eng. Pat. 14,791, July 5, 1898.

In this case a feeder, such as is described in Eng. Pat. 6703, 1898 (see above), is used, and "the nozzle" thereof is inserted into a structure of refractory material forming a constricted way or passage, which way or passage surrounds the feeder and extends therefrom to a curved part (downwards) forming the firing plate. The vapours are here decomposed. The said curved plate turns the produced gases downwards to an expansion and main heating chamber. At the end or entrance of the passage exterior to this chamber, *i.e.* where the nozzle enters, means, consisting of sliding doors or similar arrangements, are provided for regulating the supply of air to the constricted passage, whereby firing is produced with a smaller consumption of hydrocarbon than usual.—R. S.

Liquid Fuel Furnaces, Impts. in or relating to. A. J. Boult, London. From H. J. Piron, Brussels. Eng. Pat. 16,100, July 23, 1898.

The furnace to which this invention may be applied is the Bachy sliding furnace, in which the direct combustion of liquid hydrocarbons, without previous preparation or atomising, is effected. Within the fire-box is a metal box "comprising a series of receptacles for liquid fuel, each provided with one or more longitudinal grooves forming reservoirs and transverse grooves at the ends of the receptacles, air-inlets being provided between the longitudinal flanges of the receptacles which support longitudinal 'wick' or capillary plates in one or several parts, and either smooth, roughened, grooved, or perforated." The plate wicks are made "of a mixture of quartz sand and liquid soluble glass," the "mixture being formed into masses of the required shape, and burned to produce compact masses, having the necessary porosity for acting as capillary wicks." The wicks, when provided with holes, may be filled with fibrous incombustible material forming auxiliary wicks, for facilitating the lighting of the liquid fuel.—R. S.

Gas, Impts. in or relating to Apparatus for Scrubbing and Filtering. W. G. Willis, Bristol. Eng. Pat. 16,868, Aug. 4, 1898.

This apparatus consists of "an outer casing having apertures for the passage of gas to the interior, an inner casing carrying sliding trays, dividing plates or partitions adapted to cause the gas to pass through suitable filtering material carried in said trays, an inlet and outlet pipe so arranged that the gas passes through a packing of coke or other suitable substance, carried between the outer and inner case, and thence through the filtering material carried in the trays aforesaid, and then to the outlet."—C. S.

Gas, An Improved Washer or Scrubber for Purifying. A. E. N. and S. N. Yeadon, Leeds. Eng. Pat. 17,838, Aug. 19, 1898.

The inventors employ a horizontal cylinder provided with outside bearing rollers and fitted with gas-tight end boxes or mouthpieces, which cylinder contains an internal central tube and a continuous spiral screw attached to the same for working the purifying liquid continuously and automatically through the cylinder. Suitable fixed, perforated division plates are also provided in the cylinder to retain in position the wood balls, grids, or other materials for washing or scrubbing the gas; and the washing liquid is raised automatically from the bottom of the cylinder and poured over the wood balls, &c., by means of suitable internal buckets, the foul liquid being raised from the bottom of the cylinder and delivered into a central discharging outlet by means of spiral vanes or channels at the discharging end of the cylinder.—C. S.

Gas, Illuminating; Process for the Production of Continuous and Durable Platinum Gas-lighting Pellets for. J. Perl, Berlin. Eng. Pat. 18,932, Sept. 5, 1898.

The process consists in reducing the platinum salt within the pores of an incombustible material by known means, and subsequently extracting the resulting hygroscopic compounds (*e.g.*, magnesium oxychloride) present as impurities, by washing with acid and subsequently with water.—C. S.

Gases Issuing from Blast Furnaces and from Coke Ovens, Impts. in or relating to the Utilisation of the. E. D. y Crooke, Bilbao, Spain. Eng. Pat. 23,079, Nov. 2, 1898.

Instead of using a portion of the gases from coke ovens for heating the ovens in which they are generated, the whole of such gases is used (after separation of the by-products) for heating or lighting or for use in gas engines. The coke ovens are heated by the gases from adjacent blast furnaces, these gases being first heated in suitable heat regenerators to between 700° to 900° C., while the air that is to support the combustion is similarly heated to the same temperature. Drawings, showing diagrammatically an arrangement of apparatus for carrying out the invention, are given and described. All the apparatus is well known, except an alternative form of heat regenerator or stove, which is formed as a vertical cylindrical casing having a refractory lining and divided by a vertical partition into two parallel vertical compartments connected at the top, one being larger than the other. The larger compartment is charged with refractory brickwork, and is provided at the bottom with inlets and an outlet. The smaller compartment has an inlet at the bottom for the heating gases, and higher up an outlet for the gas or air that has been afterwards heated by passing through the hot chambers in the reverse direction. —R. S.

Gaseous Bodies, An Improved Method of and Apparatus for the Purification of. A. L. Lion, Paris. Eng. Pat. 7790, April 13, 1899.

Smoke, fumes, air, and gases generally are purified from solid bodies by causing the smoke, &c., to pass, either upwards or downwards, through an upright cylinder in which is arranged one or two horizontal rotating screw fans, driven either by a jet of steam or water playing upon one of the fans, or by a falling spray of water. The water containing the impurities in suspension, runs away from an outlet at the bottom. When arranged for use in the chimneys of locomotives, the screws may be operated by the exhaust steam present with the smoke.—R. S.

Gases under Pressure, Impts. in Apparatus for Generating. H. M. Williams, Fort Wayne, Indiana, U.S.A. Eng. 9194, May 2, 1899.

The apparatus is for the storage, in a suitable reservoir, of "exploded gas or hydrocarbon mixed with air in a highly compressed state," for subsequent use as "motive power for driving various forms of engines," and includes "the combination with a cylinder provided at one end with valve-controlled inlet and discharge ports, a reservoir communicating with the latter port, an exhaust port leading from the cylinder, a piston within the cylinder, means (an engine) without the cylinder for moving the piston through a part of its stroke, and means for igniting a charge upon one side of the piston at a fixed time," with other necessary appliances.—C. S.

Gasoline Gas Apparatus or Carburettors. J. C. Fell, London. From H. B. Cornish, Minneapolis, U.S.A. Eng. Pat. 8572, April 24, 1899.

Means are claimed "for holding or supplying air under pressure," "for holding a supply of gasoline or volatile fluid, a carburettor (immersed in such fluid) having a central chamber and air ducts leading therefrom" (and extending above the level of the fluid in the gasoline holder), "ducts connected with the said gasoline supply and with the said air ducts, and adapted to substantially surround the stream or current of air in each of such air ducts with gasoline at the point of juncture of the air and gasoline ducts, whereby the air is carburetted and delivered to a service pipe." —C. S.

Gas Lighter, Improved. K. von Vietinghoff-Scheel, Berlin. Eng. Pat. 19,307, Sept. 10, 1898.

The claim is for "an automatic gas lighter with a cap or plate covering the chimney of the burner, characterised by the igniting pellet being arranged under a perforation or bye-pass in the plate, with the object of forcing the gas to pass over the igniting pellet in a concentrated current, and diminishing the resistance of the plate on ignition taking place."—C. S.

Incandescence Bodies suitable for use with Gas and other Burners, Impts. in the Manufacture of. J. H. H. Duncan, London. Eng. Pat. 15,713, July 18, 1898.

The claims are for incandescence bodies made by first preparing and burning off mantles composed of thoria, thoria and zirconia, or thoria and yttria, and then spraying them with a solution of a suitable salt or salts of cerium, cerium and didymium, cerium and neodymium, or cerium and praseodymium, which salt or salts subsequently become converted into the oxides by heat.—H. B.

Incandescent Lighting and for Heating Purposes, Impts. in and in connection with Gas Burners for. C. A. Ferron, Paris. Eng. Pat. 16,571, July 29, 1898.

This specification, accompanied by four sheets of drawings, describes a system and apparatus for applying compressed gas and air to incandescent gas-lighting and to household purposes, such as heating kitchen stoves and box-irons.
—H. B.

Incandescent Mantles for Gas-Light, Impts. in Self-igniting. G. Buhlmann, Berlin. Eng. Pat. 17,575, Aug. 15, 1898.

The mantles have no separate igniting-body and have no part impregnated with platinum; but in sewing together the head of the mantle there is used, instead of the usual bobbin net, a combination of several strips impregnated alternately with platinum chloride and with the thoria-ceria mixture. For "conducting the ignition downwards," there may be attached to the heads of the mantles igniters consisting either of loosely-woven heddles or of diminutive mantles impregnated with igniting substances. The combination of platinum and oxide of cerium, and the employment of oxides of iron, silver, chromium, &c. in place of oxide of cerium, are also claimed.—H. B.

Filaments for Incandescent Electric Lamps, Impts. in the Manufacture of. O. Imray, London. From C. Auer von Welsbach, Vienna. Eng. Pat. 17,580, Aug. 15, 1898.

This refers to improvements on Eng. Pats. 1535 and 13,116 of 1898 (this Journal, 1899, 571). In ordinary osmium, certain oxides occur which cannot be completely volatilised, even at an intense white heat, and which interfere with the uniform consolidation, durability, and illuminating power of the osmium filaments. Such oxides may be volatilised out of the filaments, if other more readily volatilisable oxides are present, the filament then becoming dense and elastic. A paste is prepared of an intimate mixture of exceedingly finely divided TiO_2, an organic binding substance, and very finely divided osmium; the proportions of osmium to oxide should correspond to their equivalent weights; for example, 10 parts of Os to 4 parts of TiO_2. For titanium oxide may be substituted other oxides of more basic character, which are volatile at a white heat, such as Al_2O_3, CaO, or MgO; SiO_2 is not suitable for the purpose. From the paste, filaments are prepared as described in the previous patents referred to. The claims are for the process of purifying osmium and osmium filaments by means of titanic or other oxide, as described, and for filaments produced as above.
—H. B.

Incandescent Materials suitable for use in Electric Lighting, The Production of. S. Pitt, Sutton, Surrey. From The Pharmaceutisches Institut Ludwig Wilhelm Gans, Frankfort a/Main. Eng. Pat. 17,896, Aug. 19, 1898.

In this process the so-called lustres or lustrous preparations of the noble metals are used. Hitherto they have been used for decorating glass and porcelain, by coating the object with a suitable preparation (of gold, silver, and platinum) and then burning in. In a similar manner there are used commercially the lustres which are "organic compounds of metallic oxides soluble in ethereal oils; thus, for example, resinous acid compounds, sulphuretted resin compounds, or, again, the products of decomposition of metallic chlorides in solution in lavender oil."

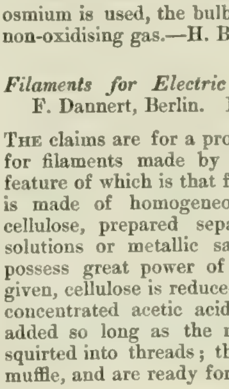
The finished incandescent body consists of (1) a core of osmium, rhodium, ruthenium, or iridium, or alloys of these, and (2) an adhesive coating of incandescence oxide, say a mixture of 99 parts of thoria and 1 part of ceria. The first of the two claims is for the process, consisting in covering a matrix (rods, tubes, discs, &c.) of glass or porcelain with a "lustrous preparation" of one or more of the platinum metals, and burning the same in; then detaching the resulting metallic film from the matrix by attacking the latter with hydrofluoric acid or other suitable solvent; and, lastly, giving the metallic film the desired shape. This film may itself be used as an incandescent body. The second claim is for the process, consisting in producing the film according to claim 1, and then coating the film with "ceramic resin lustre of one or more of the luminous earthy metals and burning the same in." The body so made can be used instead of a carbon filament, and in cases where osmium is used, the bulb must be evacuated or filled with a non-oxidising gas.—H. B.

Filaments for Electric Incandescent Lamps, Improved. F. Dannert, Berlin. Eng. Pat. 19,974, Sept. 20, 1898.

The claims are for a process for producing filaments (and for filaments made by the process), the "distinguishing feature of which is that for the forming of the filament, use is made of homogeneous combinations formed out of cellulose, prepared separately, and mixed with metallic solutions or metallic salts, the metallic oxides of which possess great power of emitting light." In the example given, cellulose is reduced to a paste-like form by means of concentrated acetic acid, and then magnesium acetate is added so long as the mixture remains capable of being squirted into threads; the threads are then carbonised in a muffle, and are ready for insertion in the bulb of the lamp.
—H. B.

Incandescence Mantles, Filaments, and the like; Improved Manufacture of. A. J. Boult, London. From A. M. Plaissetty, Paris. Eng. Pat. 63. Jan. 2, 1899.

The first claim is: "The manufacture of incandescence mantles, filaments, and the like, by suspending in the flame of a Bunsen or other burner, filaments or mantles prepared from syrupy solutions of 'incandescence' salts mixed with collodion, consisting preferably of nitrocellulose or pyroxylin dissolved in a suitable solvent, and transforming them into oxide filaments by denitrification by means of 'hydrated sulphate of ammonia or calcium,' the transformation being effected after said filaments have been submitted for several hours [to the heat of] a water-bath and dried at a high temperature" (150° to 175° C.). (See patentee's Eng. Pats. 26,381 of 1897, and 3770 of 1898; this Journal, 1899, 26 and 479.) The second claim is for a mantle support, as illustrated.



The socket F is slipped on to the burner-tube. Suitable lengths of denitrified threads are suspended from the ring C, and are uniformly distributed round the socket F, each being held in position by placing it in the corresponding notch G in the flange. Finally the ring I may be slipped down to rest on the projections of the flange, keeping the threads in position. The bent portion J, which projects beyond the mantle thus formed, enables the whole to be handled. There are also claimed supports, for mantles of the usual form, terminating in a ring upon which the plaited head of the mantle rests, the asbestos loop being dispensed with.—H. B.

Incandescent Lamp Burner, Petroleum. J. Braunschild and J. Kirchhöfer, Munich. Eng. Pat. 5458, March 13, 1899.

There is claimed, "A petroleum incandescent lamp burner having a circular wick tube, surrounded by a perforated case provided with an internal flange, said perforated case acting as a guide for a flat or slightly curved wire or perforated sheet-metal screen resting on top of the wick, means for raising the wick, a plate having holes around its exterior, arranged above the perforated case, and baffle plates arranged in the chimney, at the upper end of which is situated a conical wire screen partly within the mantle." The arrangement is said to give rise to constant, blue, smokeless flames.—H. B.

Incandescent Gas Burners, Impts. in. O. Conrad, Berlin. Eng. Pat. 7124, April 4, 1899.

In the burner described, the mixing-tube, which is rather long and has a waist-like form (a separate claim being made for this), is covered at its upper end by a disc of wire gauze; upon the latter, rests a perforated bell-shaped cover or shield, closed at its upper end by a circular plate and surrounded by a second cover or shield, open at the top, whereby a narrow annular space is formed between the upper edge of the outer shield and the circular plate of the inner shield. The upper edge of the outer shield rests within the lower edge of an incandescent mantle. The claims are for the bell-shaped devices, forming a narrow annular space.—H. B.

Incandescence Gas Burners, Impts. in and connected with. J. B. de Léry, New York. Eng. Pat. 10,705, May 23, 1899.

This refers to improvements on Eng. Pat. 9940 of 1897 (see also this Journal, 1899, 671), and describes a new method of attaching the "tassels." Instead of a carrier having radial arms, on each of which a tassel is suspended by means of a spool, the carrier consists of a horizontally arranged ring, from which the tassels are suspended by means of hooks.—H. B.

Incandescent Mantles for Gas Burners, Impts. in and relating to. C. F. Armington, Massachusetts. Eng. Pat. 11,653, June 5, 1899.

A rectangular piece of impregnated fabric is laid down flat; its sides are then folded inwards towards the middle line of the piece; the piece is once more folded along the middle line, so that the one infolded portion lies upon the other. A supporting loop of, say, asbestos, is then passed through the four thicknesses, near one end of the folded piece, and a series of "mantles" so formed, is suspended upon radial arms above a radial burner.—H. B.

Acetylene Gas, Impts. in or relating to Apparatus for Producing. A. J. Boult, London. From O. Payan, Bayeux, France. Eng. Pat. 13,830, June 21, 1898.

A number of vessels, with hinged bottoms, contain carbide, and are brought in turn, by gearing operated by the movements of the gasholder into which the gas evolved passes, over a tube through which the carbide is discharged into water in a generating tank. The bottom of this tube is automatically kept closed until a vessel is about to discharge carbide into it; or other means are adopted to prevent escape of gas through this tube.—J. A. B.

Acetylene Gas, Impts. in and in connection with the Manufacture of. M. Davoren, J. P. Belton, and J. Davoren, Carlow. Eng. Pat. 14,567, July 1, 1898.

In the top of a counterbalanced gasholder bell, is inserted a vessel containing calcium carbide, to which water gains access from the gasholder tank, through a tap controlled by a handle on the top of the bell. The gas exit from the vessel to the bell is similarly controlled. From the gasholder the gas passes to a purifier and condenser.—J. A. B.

Acetylene or like Generators and Lamps, Impts. in or relating to. L. S. Buffington, Minneapolis, U.S.A. Eng. Pat. 15,139, July 9, 1898.

A vessel containing calcium carbide is immersed in a vessel containing water, which gains access to the carbide through a drip valve, the latter being opened more fully as the consumption of carbide proceeds, by means of levers connected with a ring, which rests on the top of the carbide and rises as the latter material expands in the course of its conversion into lime. Another valve entirely cuts off the flow of water to the carbide when the operator wishes to arrest the action of the apparatus. A tapering gas outlet, the wide end of which is lowermost, is used to prevent the passage becoming obstructed by globules of condensed liquid.—J. A. B.

Acetylene Gas Generators, Impts. in. R. Williams, Birmingham, and J. H. Clarke, London. Eng. Pat. 16,479, July 28, 1898.

A carbide container situated on the crown of the bell of a gasholder, which floats in water in the annular space around a water tank, discharges carbide into the latter when a valve is opened owing to the descent of the bell, by means of a vertical rod attached to the base of the apparatus. Three modifications of the valve and operating mechanism are described.—J. A. B.

Acetylene Gas, Improved Apparatus for Generating, in a Pure State. H. R. Berger, Berlin. Eng. Pat. 16,457, July 28, 1898.

A generator is divided by vertical partitions, extending nearly to its bottom, into a series of chambers, each of which contains a series of carbide holders, which are set at different levels in the several chambers. The generator is supplied, whenever the gasholder by its descent operates a valve through a weighted lever, with sufficient water to decompose the carbide in one of the holders, and the gas thus generated passes through a washer and purifier to the gasholder.—J. A. B.

Calcic Carbide, A Method of Obtaining and Utilising the Carbon Monoxide Evolved in the Production of, and Apparatus for that purpose. B. H. Thwaite and F. L. Gardner, both of London. Eng. Pat. 16,639, July 30, 1898.

Carbon monoxide is forced from a gasholder into the carbide producer, and thence together with the carbon monoxide produced therein, escapes through a seal or check valve to the gasholder. The presence of moist air in the producer is thus avoided.—J. A. B.

Acetylene Gas, Impts. in the Method of Generating, applicable to Ordinary Acetylene Generators or to Table or other Lamps. E. Evans, Llanrwst, Denbighshire. Eng. Pat. 16,733, Aug. 2, 1898.

A series of tubes, containing carbide holders, are ranged round the margin of a gasholder, to which water gains access through a ball valve at its base from an external vessel, which is fed from a larger reservoir through a bird-fountain device which maintains it at a constant level. The carbide holders have hinged doors perforated for the admission of water, and shelves which divide them into a number of cells. The perforations are at a different level in each of the carbide holders.—J. A. B.

Acetylene Gas, An Improved Apparatus for the Production of. J. Varon, Bordeaux. Eng. Pat. 16,884, Aug. 4, 1898.

Carbide is discharged into water in a generating vessel from compartments in two or more wheels mounted on a horizontal axis, which is rotated by a lever and pawl device actuated by the movements of the gasholder into which the gas passes. A dial and index show which compartments are emptied, and a signal is given when all are emptied. A condenser coil for cooling the gas, and other accessories are provided.—J. A. B.

Acetylene Gas Generators, Impts. in. M. L. J. R. L. de Montais, Cloyes, France. Eng. Pat. 16,903, Aug. 4, 1898.

A pivoted finger on a rod attached to the bell of a gasholder releases a charge of carbide whenever the bell descends to a given point. The charges of carbide are contained in a distributor, which partially surrounds the tank of the gasholder. The distributor and bell are moved relatively to one another each time the finger engages with the distributor, and releases the charge of carbide. The effect of this movement is that another charge is brought into such a position that it will be released on the next descent of the bell. The carbide falls through a funnel and spout to a generating tank beneath the gasholder, and the gas formed, passes into the latter. Several modifications of various parts of the apparatus are described.—J. A. B.

Acetylene Generators and Lamps, Impts. in. J. Schumacher, Chicago, U.S.A. Eng. Pat. 17,088, Aug. 8, 1898. (Under Internat. Convention.)

Water is conveyed from a reservoir through a valve and porous washer to a tube which leads to a carbide chamber, in which is a moulded mass of carbide, having a cavity of inverted conoidal outline, so that the thickness of carbide decreases from bottom to top. A needle is provided for the removal of obstructions from the burner, to which the gas passes through an intermediate chamber. A clamp for attaching the lamp to a vehicle is described.—J. A. B.

Acetylene Gas, Impts. in Apparatus for use in Generating. J. W. Bailey and J. Clapham, Keighley, Yorks. Eng. Pat. 17,127, Aug. 9, 1898.

In generating apparatus in which water is admitted to carbide as required, the latter is placed in a carrier comprising several compartments, which are perforated at different levels, so that the carbide in one compartment is exhausted before that in another is attacked by the water. —J. A. B.

Acetylene Gas, Impts. in Apparatus for Generating. G. W. Emmerson, Newcastle-on-Tyne. Eng. Pat. 17,504, Aug. 13, 1898.

Water is admitted from the tank of a gasholder to a subjacent generator, containing carbide, through a pipe, and the gas evolved forces back the water, and escapes through the same pipe to the gasholder. Another pipe extends from the top of the generator above the water in the gasholder tank, and has at its upper end a valve, which is opened when the bell of the holder descends to a given point. The gas which is confined under pressure in the generator then escapes, and permits more water to flow into the latter.—J. A. B.

Acetylene Generators, Impts. in and connected with. T. Thorp, Whitefield, Lancs. Eng. Pat. 17,840, Aug. 19, 1898.

Carbide is contained in a tray which is pushed into a generating chamber to which water gains access from the tank of a superposed gasholder. The water does not fall directly on to the carbide, but flows over the sides of the tray when it reaches a given height in the chamber. The supply of water is controlled by a three-way tap operated by an external handle. In one position of the tap, water passes directly from the tank to the generator; in a second position in which the tap remains during the generation of gas the water passes first through a valve, which then remains closed until opened by a knob attached to the crown of the sinking gasholder when the latter has descended below a certain point. The flow of water is therefore interrupted when the gasholder has risen above this point.—J. A. B.

Acetylene Gas Generating Apparatus, Impts. in. J. G. Lorrain, London. From L. Ward, Cape Town. Eng. Pat. 17,892, Aug. 19, 1898.

A cylindrical chamber containing a cage of carbide passes through the lower of two tanks communicating with one another by a funnel, which extends nearly to the bottom of the lower tank. A pipe, with cock, supplies water from the lower tank to the carbide, and the gas evolved, escapes through a coil in the upper tank, to the place of consumption, or, in the event of surplus production, through the pipe by which the water was supplied to the lower tank, whence it forces water temporarily to the upper tank. The flow of water to the carbide is thus controlled by the pressure within the generating chamber.—J. A. B.

Acetylene Gas Lamps for various Purposes, Impts. in. C. A. and F. J. Miller, both of Birmingham. Eng. Pat. 17,997, Aug. 22, 1898.

A spool-shaped body accommodates externally a reflector and burner, and contains a water reservoir and a gas-filtering chamber. To its base there is screwed a chamber containing carbide, to which water is admitted from the reservoir through a coned valve operated by a head on the top of the lamp. The head is provided with an index to serve as a guide in regulating the supply of water. The gas passes through the filtering chamber to the burner.—J. A. B.

Illumination Photometer. C. W. S. Crawley, Clerkenwell, London. Eng. Pat. 19,087, Sept. 7, 1898.

See under XXIII., *page* 788.

Illuminating Bodies or Filaments composed of Second-Class Conductors (Electrolytes), A Resistance Method of and Means for Regulating the Supply of Current for. V. I. Feeny, London. From Allgemeine Elektricitäts Gesellschaft, Berlin. Eng. Pat. 6027, March 20, 1899.

The claims are as follows:—

1. A method of regulating the supply of current for illuminating bodies or filaments composed of second-class conductors, the distinguishing feature of which is that the resistance is formed or made of a material having the highest possible temperature coefficient ("such as nickel, iron, platinum, or metal alloys possessing similar properties, which expand rapidly under varying intensity of current,") "and is heated prior to the glowing or lighting up of the illuminating body or filament . . ."

2. . . "the heating apparatus for exciting the illuminating body is simultaneously employed for preliminarily heating the resistance. . ."

3. . . "the resistance for the illuminating body or filament is simultaneously employed in the same capacity for the heating body, with the view of the resistance being heated by means of the heating current . . . ."

"Illuminating bodies or filaments composed of second-class conductors (electrolytes), cannot be directly introduced into a circuit or system, but absolutely require a special resistance, since they do not conduct as metals, but as electrolytes."—J. C. R.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

Lignite Tar, Contribution to the Chemistry of. E. Oehler. Zeits. angew. Chem. 1899, [24], 561—563.

The author has investigated the character of the so-called neutral oils, which are extracted by caustic soda of 20° B. in the purification of mineral oils. On diluting the alkaline solution with a large volume of water, an oily layer invariably separates. This was shaken up with concentrated sulphuric acid to remove unsaturated hydrocarbons and obtain an oil capable of resisting the action of permanganate. The resulting product had a strong odour of petroleum, a specific gravity of 0·900, and yielded, on distillation, the following fractions:—18 per cent. up to 200°, 48 per cent. up to 250°, 75 per cent. up to 300° C. From the fraction boiling between 110°—115° dinitrotoluene was obtained, the yield corresponding to 34 per cent. of toluene. The fraction boiling between 135°—140° C. yielded 24 per cent. of metaxylene. The presence of aliphatic hydrocarbons was established in a higher boiling fraction, from which nonane and decane were isolated. From the fraction boiling between 200°—220° naphthalene was obtained by treatment with picric acid, whilst paraffin was detected in the fraction boiling above 300° C.

These results show that a strong solution of caustic soda not merely extracts phenols, but may also dissolve mineral oils as such in small quantities.

The author has also studied the character of the bases obtained from lignite oils in the process of purification with sulphuric acid. The presence of pyridine, quinoline, and similar bases has already been established. From a fraction of lignite tar, bases boiling between 170°—190° C. aniline has recently been isolated by dissolving the basic mixture in dilute hydrochloric acid, treating the solution with sodium nitrite and β-naphthol, and reducing the resulting azo-colouring matter with stannous chloride and hydrochloric acid.

In conclusion the isolation of a hydrocarbon of the formula $C_{16}H_{18}$ is referred to, the separation having been effected by means of picric acid from a fraction of lignite tar yielding 80 per cent. of distillate between 290° and 320° C. It melts at 117°, distils at 300° to 303°, and sublimes in the form of lustrous needles at the temperature of the water bath. It is readily soluble in ether, carbon bisulphide, benzene, chloroform, and acetone. Its picrate forms red needles melting at 154°. The author is continuing the investigation of the hydrocarbon in question.—D. B.

Petroleum Oils: Viscosity Determinations (Engler). D. Holde. Mitth. k. techn. Versuchsanst. Berlin, **17**, [1 and 2], 62—68.

a. Changes in the Water Value of the Instrument.—According to the results published in the paper, the opinion occasionally expressed that the water value of the Engler viscosimeter is liable to change in consequence of the erosion of the jet, appears to be without foundation; and it is considered that an annual examination of the instrument, in this particular, is sufficient.

b. Preliminary Treatment of Dark Oils.—In repeat tests, discrepancies beyond the limits of experimental error may be due to fluctuations in the degree of fluidity of the oil, or to accidental mechanical impurities. The former may be overcome by definite preliminary treatment, or allowing a certain margin ($\pm$ 7·5 per cent.), and the latter by filtration. Hot-filtering being, however, apt to considerably modify these dark lubricating oils, it is considered preferable to pass them through a cup-shaped sieve ($\frac{1}{3}$ mm. mesh), the fluid oils being strained at ordinary temperature, and the thicker kinds after warming to fluidity over the water-bath. The temperature should be recorded as well as the particulars of the removed impurities. This strained oil can also be used for the "cold test," without being open to any objection on the score of modification by such treatment. A finer sieve than that mentioned is not recommended, the operation being thereby unduly protracted.

c. Viscosity Determinations with Small Quantities of Oil.—In cases where the volume of oil at disposal is below the regulation quantity for the Engler instrument ($\frac{1}{4}$ litre), approximately accurate estimations may be made by charging the cup with 45 c.c. (+ 2 c.c. to allow for retention by surface attraction) and measuring the outflow of 20 c.c., the result being converted to the normal figure (200 c.c.) by multiplication with a factor, determined by the author as averaging 724. The greatest margin of error in this method is 6 per cent., which is considered near enough for technical purposes.—C. S.

Petroleum Spirit and Cleaning Oils, Inflammability of. Holde and Pelgry. Mitth. k. techn. Versuchsanst, Berlin, **17**, [1 and 2], 68—72.

a. Petroleum Spirit.—For flashing point determinations in the case of this highly inflammable product, the authors employed the oil cup of the Abel tester, filled up to the usual mark, and immersed in a cylindrical metal vessel $5\frac{1}{2}$ cm. deep and $8\frac{1}{2}$ cm. wide containing alcohol, the whole being placed in an enamelled iron outer vessel, 7 cm. deep and $16\frac{1}{2}$ cm. wide, fitted with a jacket of felt, and charged with a refrigerating mixture of alcohol and solid carbon dioxide. By this means the temperature in the Abel cup could be reduced to − 60° C. An alcohol thermometer (agreeing with an accurate mercury one at − 20° C.) was used. In applying the test the Abel cup and smaller vessel were taken out of the refrigerating mixture, to prevent the extinction of the test flame by the evolved carbon dioxide. To prevent the oil from freezing, the test flame lamp was not put into position until just before commencing the test, which was repeated at $\frac{1}{2}$° intervals as in the case of ordinary petroleum. The ignition point was determined after the flashing point, by removing the cover of the Abel cup and applying a blowpipe flame at $\frac{1}{2}$° intervals.

The results are given in the appended table and show a great divergence in the properties of the various grades, that boiling at 50°—60° C. flashing at −58° C., whilst that boiling between 100° and 150° C. flashes at +10°, and ignites at 15° C.

Range of Boiling Point.	Sp. Gr.	Initial Temperature.	Flashing Point.	Ignition Point.
° C.		° C.	° C.	° C.
50—60	..	..	Below −58	..
60—78	..	−54 to −65	−37·5 to −39	−33·5 to −34·5
70—88	0·695	−50 to −53	−44 to −46·5	−41·5 to −42
80—100	..	..	−22 to −22·5	Ignited immediately lid removed.
80—115	..	..	−27·5	−19
	..	−22 to −22·5	−36 to −60	Ignited immediately.
100—150	..	..	+10 to +12	+ 16
	..	..	+10	+ 15

b. Cleaning Oils.—A number of these oils prepared from petroleum, lignite tar, or resin, were examined by the same method, one sample of lignite tar distillate (distilling point 210° C.) flashing at 69° and burning at 81° C. The petroleum distillates exhibited a wide range of flashing point (38°—155° C.) mostly below 100° C., as also great differences in the ratio between flashing and igniting points, the latter being in some instances only 4° C. above the former, whilst in others the difference amounted to over 80° C.—C. S.

Benzine, Substitute for. A. Ganswindt. Zeits. angew. Chem. 1899 [23], 537.

The author calculates the annual consumption of this article in Germany as 10,000,000 kilos. for laundry purposes only. He calculates the total consumption as 100 million kilos. Unfortunately, however, it is highly inflammable and forms explosive mixtures with air. Hence, frequent fires, often accompanied by loss of life. A substitute for benzine has been found in carbon tetrachloride. But as long as carbon bisulphide has to be used for its preparation, objectionable impurities cannot be avoided, amongst them some residual CS_2. Acetylene ought to be a desirable raw material for the manufacture of a useful substitute. Although Berthelot observed that acetylene and chlorine react upon ignition, it has been found by Roemer that when acetylene has been standing for a day, a small quantity of carbon will have separated, and the pure gas will then quietly combine with chlorine, the presence of light being essential.

A valuable substitute for benzine has to satisfy the following requirements:—

1. It must be free from danger of inflammability and explosion.

2. It must be completely volatile without leaving any odour.

3. It should be a uniform chemical substance and not a mixture, so that only distillation, but not fractionation should be required.

4. It must dissolve fats, resins, and oils as readily as benzine.

5. It must not freeze at the average winter temperature.

6. Its vapours when inhaled must not act as an anæsthetic.

7. Its price should be as nearly as possible that of benzine.—S. K.

Benzine (Petroleum Spirit) and Carbon Tetrachloride Question, A Contribution to the. W. Zanker. Leipziger Färber und Zeugdr. Zeit. 1899, **48**, [22], 237—238.

In consideration of the view that probably in the future carbon tetrachloride will largely replace benzine in washing and cleansing operations, the author makes the following observations:—

At the present time the cost of manufacture of carbon tetrachloride is about four times that of benzine. It has a comparatively high specific gravity, 1 litre weighing 1,600 grms., whereas 1 litre of benzine weighs 664 grms. In other words, 1 kilo. of carbon tetrachloride occupies 0·624 litre, whilst 1 kilo. of benzine occupies 1·515 litre, or nearly 2½ times as much space. Since, in washing operations, generally speaking, equal volumes would have to be taken for comparison, it follows that carbon tetrachloride is much the more expensive. Comparative experiments were made by treating equal quantities of rags with the two solvents under the same conditions, and then wringing out to the same extent. The rags absorbed more than twice as much carbon tetrachloride as benzine. It is true, however, that at the ordinary temperature the evaporative capacity of the latter is about twice that of the former.—C. M.

Adipic Acid, Formation of, from the Naphthene fraction of Russian Petroleum Spirit boiling at about 80° *C.* O. Aschan. Ber. 1899, **32**, [10], 1769.

It has been recently proved, that the natural naphthenes as the author maintained (this Journal, 1893, 349), contain pentamethylenes as well as hexamethylenes. Markownikoff (this Journal, 1897, 606) identified adipic acid amongst the products obtained with nitric acid and the author now not only confirms this observation, but was also able to work out a method by which this acid may be easily prepared. By repeated distillation of the Baku petroleum spirit (20 litres) 1·5 litres of the fraction 78°—82° C., sp. gr. = 0·752 were obtained. This hydrocarbon was heated with ten times its volume of concentrated nitric acid (1·42) in a retort. After 50—60 hours boiling, $\frac{3}{4}$—$\frac{4}{5}$ of the contents were distilled off and the residue was evaporated on the water-bath. It solidified to a crystalline, almost white mass, which was well triturated with an equal volume of water. The crystals after 12 hours standing were pressed and dissolved in ammonia. The solution was twice extracted with ether and then boiled with concentrated hydrochloric acid. On cooling, the adipic acid crystallised out in large plates, melting after one recrystallisation, at 149·5° C. The amide $C_4H_8(CO \cdot NH_2)_2$ had the melting point 222° C.

100 grms. of the hydrocarbon yield on the average 17—18 grms. of the acid. Adipic acid, now costing 5*s.* per grm., could thus be easily manufactured on a commercial scale. It is a substance no doubt applicable for many synthetical purposes, and it might pay the petroleum distilleries to keep the fraction boiling at 78°—82° C. specially for this purpose.—S. K.

PATENTS.

Hydrocarbon and other Liquids, Improved Means for Storing. J. Smith, Penge, Surrey. Eng. Pat. 24,114, Nov. 15, 1898.

The storage tank is provided with means whereby the liquid, as it is drawn off, is displaced, and replaced by a liquid such as water, of a greater specific gravity, thus preventing the formation of mixtures of vapour and air within the tank, and, when used on board ship, &c., preventing the violent agitation of the liquid within the tank. The discharge tube passes from the bottom through and above the top, the liquid passing from the top of the tank through perforations in the discharge tube, and up the latter to a suitable draw-off cock. The heavier displacing liquid is supplied by a pump, &c., through a delivery tube, which terminates near the bottom of the tank. An indicator, operated by a float, is provided to show the quantity of liquid drawn off or remaining.—R. A.

Acetic Acid, Pure; An Improved Process for Producing. F. J. Bergmann, Neheim-on-the-Ruhr, Germany. Eng. Pat. 5926, March 18, 1899.

Calcium chloride solution is added to acetate of lime lyes in proportion to form the known double salt, and the solution is concentrated, cooled, and the magma of crystals formed is separated from the liquor by centrifugal power. The double salt thus produced is distilled with, preferably, hydrochloric acid, to obtain pure acetic acid. The residue of calcium chloride is available for use again.—E. S.

Anthracene, Improved Process for the Purification of. The Aktiengesellschaft für Theer- und Erdöl-Industrie and G. Kraemer, Berlin, Germany. Eng. Pat. 7868, April 14, 1899.

The crude anthracene containing about 30 per cent. of real anthracene, is fused and allowed to cool until about 50 per cent. has crystallised when the mother liquor is run off and again allowed to crystallise. The second crop of crystals may be raised to the value of the first crop (about 45—50 per cent anthracene) by another fusion. The crystals obtained, are again fused and treated with caustic potash lye (50 per cent.) in sufficient quantity to react with the carbazol present. The mixture is heated with constant agitation to a temperature not exceeding 260° C., and after the reaction is complete, the melt separates into two layers, the lower consisting of fused potassium carbazolc. The upper anthracene layer is then run into its own volume of 90's benzol which dissolves any phenanthrene, and the anthracene remaining undissolved is pressed or centrifuged and again washed with the same solvent when it is obtained as a pale brown powder containing upwards of 90 per cent. of anthracene according to the length of time of the final washing.—T. A. L.

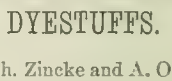
Benzoic Acid from Coal-Tar Oil, Process for the Production of. The Aktiengesellschaft für Theer- und Erdöl Industrie and G. Kraemer, Berlin. Eng. Pat. 7867, April 19, 1899.

See under XX., *page* 785.

IV.—COLOURING MATTERS AND DYESTUFFS.

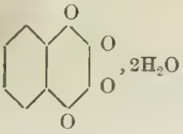
Isonaphthazarin. Th. Zincke and A. Ossenbeck. Annalen, **307**, [1 and 2], 1—28.

This product is obtained by the action of hypochlorous acid on β-naphthoquinone and decomposition of the intermediate compound formed by means of an acid. The quantities employed are as follows:—The β-naphthoquinone obtained from 300 grms. of commercial Orange II. (Annalen, **278**, 188, Note 12), is stirred up with 800 c.c. of water and sufficient hypochlorous acid solution (4 per cent.) is added to dissolve the quinone to a yellow solution. After filtering, this is made acid with acetic acid, and subsequently boiled with about 5 c.c. of dilute hydrochloric acid (1 : 5) in an open dish, when isonaphthazarin separates in red or brownish red crystals, which after extracting with ether and alcohol are quite pure. The yield is 40—45 grms. It is important to use acetic acid for acidifying since, if hydrochloric acid alone be employed the isonaphthazarin is contaminated with an oxyproduct, the constitution of which has not been determined. Isonaphthazarin, of which the formula is—



melts at 280° C., and crystallises from glacial acetic acid in brown metallic plates, or from toluene in thin red needles. It dissolves in caustic soda lye with a deep blue colour and gives a more violet solution with carbonates. Both these solutions decolorise in contact with air, the isonaphthazarin being converted into phenylglyoxylcarboxylic acid. Isonaphthazarin gives a mono and a diacetyl compound. The former separates from glacial acetic acid in orange coloured needles melting at 172° C., whilst the latter crystallises in almost white matted needles and melts at 105° C. On reducing isonaphthazarin with zinc and sulphuric acid, it is converted first into tetrahydroxy and subsequently into

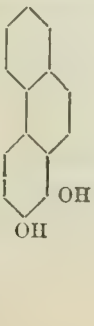
1.2.3.trihydroxynaphthalene (naphthopyrogallol). When isonaphthazarin is oxidised with dilute nitric acid it yields tetraketohydronaphthalene—



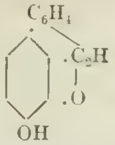
which is easily reconverted into isonaphthazarin on heating. By the action of hydroxylamine, isonaphthazarin is converted into a 2.3.dioxime which when boiled with an excess of *o*-phenylene diamine in glacial acetic acid yields naphthodiphenazine and this can also be obtained directly from the tetraketohydronaphthalene, but under no circumstances has it been possible to obtain from this substance a condensation product containing only one *o*-phenylenediamine radicle although isonaphthazarin itself yields first dihydroxynaphthophenazine and subsequently naphthodiphenazine when condensed with *o*-phenylenediamine.—T. A. L.

Morphine, Decomposition Products of, free from Nitrogen [Morpholquinone, a Chromogen]. E. Vongerichten. Ber. **32**, [9], 1521—1524.

In the course of an investigation of the oxidation of methylmorphol, the oxidation product of diacetylmorphol was examined. The yield of diacetylmorpholquinone $C_{19}H_{12}O_6$ is 50 per cent. of the weight of the original substance, the product forming yellow needles melting at 196° C. from glacial acetic acid. It condenses with *o*-tolylene diamine forming an azine which dissolves in concentrated sulphuric acid with a deep blue colour turning red on dilution, and melting at 215°—218° C. If diacetylmorpholquinone be treated with sodium methylalcoholate it dissolves with a cherry-red colour, which rapidly changes to a deep blue. Dilute mineral acids precipitate the free dihydroxyphenanthraquinone as a red flocculent precipitate. This substance is a mordant dyestuff giving deep violet shades on alumina and pure blue on chromium mordants, behaving thus similarly to alizarin. Oxidation of morpholquinone with permanganate, yields phthalic anhydride, whilst oxidation of the above-mentioned dioxytoluphenanthrazine gives a yellow acid, with a sparingly soluble calcium salt, which, when heated in water yields a base insoluble in alkalis, having the properties of α-β-tolunaphthazine. Reviewing the work which has been done on morphenol $C_{14}H_7O.OH$ and morphol $C_{14}H_8(OH)_2$ it is now possible to write their constitutional formulæ. They are both derivatives of phenanthrene, since this hydrocarbon is obtained by heating morphenol with zinc dust, whilst morphol is formed by the action of reducing agents on morphenol, and on oxidation it is converted into an orthodiketone. Since morpholquinone on oxidation yields phthalic acid, the hydroxyl groups are present in one benzene ring, and this is also confirmed by the formation of protocatechuic acid, obtained by fusing morphine with caustic potash. A further proof of this configuration lies in the fact that morpholquinone is a polygenetic dyestuff, dyeing mordants, whilst its methyl ether does not do so. This is also the case with alizarin and its methyl ether, which thus behave analogously. Moreover, it has been observed that in hydroxyanthraquinones, not only is the *o*-position of the hydroxyl groups a necessity for a mordant dyestuff, but there must also be a certain degree of proximity between the auxochromic groups and the chromophor. Regarded in this light, morphol has the formula—



from which it follows morphenol has the constitution—



It is, however, not certain to which of the two central carbon atoms the oxygen is attached, but the substance is exceedingly stable, a fact which precludes the probability that it has a constitution analogous to those of the aromatic oxides of Zincke and Auwers.—T. A. L.

Tertiary Aromatic Amines and Tetra-alkylated Aromatic Diamines, Preparation of Pure. J. Pinnow. Ber. **32**, [9], 1401—1408.

The method consists in heating the alkyl haloid addition products of aromatic amines, or their derivatives, with ammonia to a high temperature. The temperature to which it is necessary to heat these addition products depends upon the presence and number of acid or basic groups, monamines and amidocarboxylic acids only requiring a temperature of 110°—140° C., whilst diamines and amidophenols must be heated to 180°—190° C., the reaction taking about one hour at this temperature, or 2—3 hours at the lower one. The ammonia is converted thereby into mono-, di-, and trimethylamine. Results obtained with the following bases are given in the paper, the three phenylene diamines, benzidine, *o*-amidophenol, *p*-amidobenzoic acid, and the naphthylamines. For example, 12 grms. of *p*-amidodimethylaniline hydrochloride and 9·5 c.c. of methyl alcohol are heated for six hours to 179°—193° C. After basifying with ammonia and rectifying, 2·5 grms. boiled at 259°—261° C., and on heating the aqueous solution with 10 c.c. of ammonia for 2¼ hours to 186°—189° C., 5·1 grms. of a product boiling at 260°—261° C. were obtained, the total amount being thus 7·6 grms., or 81 per cent. of the theoretical. In the case of α-naphthylamine no ammonium base appears to be formed, but an 80 per cent. yield of the dimethyl derivative is obtained directly by heating the hydrochloride with methyl alcohol to 169°—175° C. for six hours. With regard to *p*-dimethylamidobenzoic acid, which hitherto has been obtained by boiling amidobenzoic acid with potash, methyl iodide and wood spirit, or else by hydrolysing the nitrile, it can be formed according to the author, by oxidising dimethyl-*p*-toluidine with permanganate, having previously protected the dimethylamido group by the addition of methyl chloride, which is subsequently split off on heating with ammonia. The reactions do not, however, proceed smoothly and the oxidation is incomplete, but it is noteworthy that the presence of the carboxyl group has no retarding effect in splitting off the alkyl haloid as in the case of the amido and hydroxyl groups.—T. A. L.

Ortho-amidodimethylaniline. E. Bamberger and F. Tschirner. Ber. **32**, [11], 1903—1907.

By the action of nitrous acid on dimethylaniline oxide (Ber. **32**, 349) Bamberger obtained *o*-nitrodimethylamine. This product, on reduction with salammoniac solution and zinc-dust, yields *o*-amidodimethylaniline, which is volatile with steam. The substance is a colourless mobile oil, distilling at 99·5°—101° C. under a pressure of 20—25 mm. having an odour of camphor, sparingly soluble in water, and easily soluble in organic solvents and mineral acids. The aqueous solution treated with an excess of ferric chloride turns yellowish-brown, then violet, and finally blue, and, on boiling, dark red. Bleaching powder turns it reddish-brown, and bichromate and sulphuric acid a brown-greenish-black. The condensation product with salicylic aldehyde is yellow, whilst benzoyl chloride and soda-lye yields benzoyl-*o*-amidodimethylaniline, which crystallises from wood-spirit in needles. The base exhibits a peculiar reaction when its diazo compound is boiled, the products being nitrogen, formaldehyde, and monomethylaniline. In addition, a base, volatile with steam, of unknown constitu-

tion, is obtained, together with probably N-methylbenzimidazol and a small quantity of dimethyl-*o*-amidophenol.
—T. A. L.

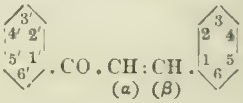
p-Nitrobenzyl Chloride on Dimethylaniline and Diphenylamine. Action of [*Diphenylamine Blue*]. E. Wedekind. Annalen, **307**, [3], 283—293.

When dimethylaniline and *p*-nitrobenzylchloride are mixed in the cold, combination takes place, forming a small quantity of *p*-nitrobenzylphenyldimethylammonium chloride. In attempting to increase the yield, the mixture was heated, when a violent reaction takes place, one of the products being Methyl Violet, another being possibly *p*-nitrotetramethyldiamidotriphenylcarbinol.

The action of *p*-nitrobenzylchloride on diphenylamine proceeds much more regularly, giving a good yield of Diphenylamine Blue, the by-product forming a greenish-blue powder, of which the constitution is not known. Nitrosodiphenylamine reacts in the same way as diphenylamine. For the preparation of Diphenylamine Blue, 20 grms. of nitrobenzylchloride and 19 grms. of diphenylamine or 23 grms. of nitrosodiphenylamine are heated together until the melt turns dark blue or violet-blue respectively. After distilling off unaltered products with steam, 34 grms. and 37 grms. respectively of crude dyestuff were obtained. The melt is then powdered, and digested with warm chloroform until the latter no longer extracts any colouring matter. The bluish-green substance extracted, was not further examined. The Diphenylamine Blue remaining undissolved, showed all the properties of this substance, and crystallised from aniline-ether. It dissolves in concentrated sulphuric acid with a brownish-red colour, and separates from this solution as a blue flocculent precipitate on adding water. It dyes silk from a broken soap bath, strong deep blue shades.—T. A. L.

Oxybenzalacetophenones [*New Chromogens*]. *The Six Isomeric* (*Oxychalkones*). St. v. Kostanecki and J. Tambor. Ber. **32**, [11], 1921—1926.

In view of the differences observed in the colours of isomeric hydroxylated compounds, for example, the *o*-, *m*-, and *p*-nitrophenols, and the oxyxanthones (Ber. **26**, 76), and the bearing that these instances have on the relation of constitution to colour, the authors, in order to examine further examples have prepared the three oxybenzalacetophenones containing the hydroxyl group in the ketone radicles. Since benzalacetophenone is closely allied to other chromogens such as benzalcumaranone, benzalindandione and flavone, and is moreover of importance in its relation to quinone for the theory of dyestuffs, they propose to employ the name "*chalkone*" for the parent substance, together with the following nomenclature:—



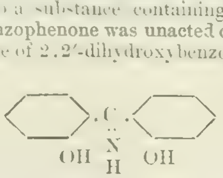
The compounds are obtained by condensing benzaldehyde with *o*-, *p*-, and *m*-hydroxyacetophenone in presence of soda lye. The following table gives some of the properties of the compounds obtained:—

Name.	Crystalline Form.	Melting Point.	Solution in Soda-lye.	Solution in Concentrated Sulphuric Acid.	Melting Point of Acetyl Compound.
		° C.			° C.
2′-Oxychalkone	Yellow needles	89	Orange	Yellow	52
3′-Oxychalkone	Light yellow plates	126	Yellow	Yellowish-red	101
4′-Oxychalkone	Yellow needles	173	Yellow	Yellowish-red	90
2-Oxychalkone	Yellow plates	155	Yellowish-red	Yellowish-red	69
3-Oxychalkone	White plates	160	Light yellow	Yellow	103
4-Oxychalkone	Light yellow spangles	183	Deep yellow	Orange	131

The oxychalkones hydroxylated in the ketone radicle show less well marked differences than the three isomerides. The 2′-oxychalkone is reddish-yellow in colour, and gives a sparingly soluble intensely yellow sodium salt, thus differing from all other monoxychalkones. On gently warming the solution it turns orange. The 4′-oxychalkone is also reddish-yellow, but it dissolves to a yellow solution in dilute caustic soda, so that a similar difference between *o*- and *p*-derivatives exists in this case also as in those already known. The 3′-oxychalkone is only a faint yellow, and its alcoholic solution is much less coloured than that of *p*-oxychalkone. On the other hand its alkaline solution is yellow, and certainly not lighter than that of 4-oxychalkone.—T. A. L.

Auramine, Constitution of. C. Graebe. Ber. **32**, [10], 1678—1683.

In the course of some work on oxybenzophenones, the author (Annalen, **269**, 321) found that 2.2′-dihydroxybenzophenone (xanthonic acid) was readily converted on heating with ammonia into a substance containing nitrogen, whilst 4.4′-dihydroxybenzophenone was unacted on. The product formed is the imide of 2.2′-dihydroxybenzophenone and has the formula—



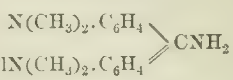
In the case of *o*-hydroxybenzophenone, this substance cannot be converted into an imide, but on heating with aniline to 130°—140° C. condensation takes place and hydroxybenzophenone phenylimide is obtained. In general the ketonic oxygen in benzophenone derivatives is only replaced easily by the NC_6H_5 group when one *o*-hydrogen at least is replaced by some other element or radicle. Benzophenone itself can, however, be converted into its phenylimide derivative by heating it to 240°—250° C. in a long-necked flask, and running in gradually 3—4 times its weight of aniline. After cooling to 100° C. a small quantity of alcohol is added, and the melt is poured into water containing a little acetic acid. A good yield of benzophenone-phenylimide $(C_6H_5)_2:C:N.C_6H_5$ is obtained, and after washing with cold alcohol to remove benzophenone, the product melts at 113° C. In a similar manner 4.4′-dihydroxybenzophenone yields an orange-yellow phenylimide. Like benzophenone-phenylimide itself all the derivatives are yellow, and are more highly coloured the greater the number of hydroxyls present. They all possess the chemical characteristics of Auramine, forming yellow salts with hydrochloric acid, which on warming with water decompose into aniline hydrochloride and the corresponding benzophenone derivative. These observations confirm the author's original view that Auramine is a ketone imide having the formula—

$$[N(CH_3)_2.C_6H_4]_2:C:NH$$

whilst the commercial dyestuff has the constitution—

$$[N(CH_3)_2.C_6H_4]_2:C:NH.HCl.$$

Stock (J. prakt. Chem. **47**, 401), assumes that the hydrochloride has a quinonoid constitution—

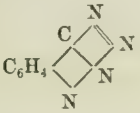


$$\begin{matrix} N(CH_3)_2.C_6H_4 \\ ClN(CH_3)_2.C_6H_4 \end{matrix} \Big\rangle CNH_2$$

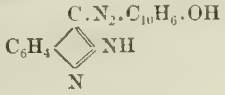
If this were so, there would be a considerable difference between the colour of the base and its hydrochloride, which snot the case. Moreover, although aniline converts Auramine hydrochloride into phenylauramine, methylaniline does not react, which accords with the view that the Auramine salts also contain the group C:NH. Hence Auramine and its salts owe their colour to the presence of this group, and are to be considered as ketone-imides. With regard to its colouring power, the chromophoric group C:NH stands midway between the chromophors CO and CS.—T. A. L.

Diazo-Compounds (Triazolenes). A New Class of. E. Bamberger. Ber. **32,** [10], 1773—1797.

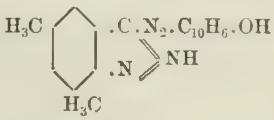
By the action of nitrous acid on amidoindazol and treatment with potassium acetate, a compound results having the formula—



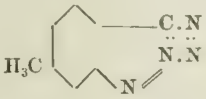
which is the type of the new series of diazo compounds. It possesses the properties of amido-indazol and indazol in giving double compounds with silver nitrate and sublimate and a bromine product with bromine water, but at the same time it acts as a true diazo compound, combining in acid, neutral and alkaline solutions with aromatic bases or phenols with great rapidity. These new diazo compounds are very stable, and can be kept, when pure and dry, for many months. They are also volatile with steam, although a certain amount of decomposition occurs in the process. Alkalis decompose the new compounds, but the resulting products have not been fully investigated. Acids dissolve the indazoltriazolenes, forming salts which are readily decomposed by acetates. Alcohol, on gentle warming, converts indazoltriazolene hydrochloride into indazol, nitrogen being evolved simultaneously, whilst concentrated hydrochloric acid in presence of cuprous chloride yields chlorindazol. Hydriodic acid forms iodindazol, whilst boiling hydrobromic acid produces a number of compounds, the acid acting as a reducing and a brominating agent. In its physical properties indazoltriazolene resembles certain azines, having a yellow colour, dissolving in most organic solvents and being volatile with steam. The yellow colour changes in direct sunlight to a dirty brown. In addition to indazoltriazolene, the author has also examined methyl and dimethyl indazoltriazolene, both of which possess similar properties. For the preparation of indazoltriazolene, a solution of 3·2 grms. of amidoindazol in 38 c.c. of dilute (2-norm.) with 8 c.c. of concentrated hydrochloric acid and 60 c.c. of water, is cooled externally with ice and diazotised with 17 c.c. of sodium nitrite solution (10 per cent.). The filtered solution is treated with 35 grms. of potassium acetate in 16 c.c. of water and after a short time a crystalline precipitate of 2·7 grms. of pure indazoltriazolene separates out. A further quantity can be salted out and extracted with chloroform, the total yield after purification, being 3·5 grms. Indazoltriazolene forms golden yellow flat silky needles melting at 106° C., very easily soluble in acetone, acetic acid, chloroform and hot alcohol, less so in ether (1 grm. in 90 c.c.), and sparingly in cold petroleum ether. The hydrochloride melts at 201°·5 C., dissolves with a yellow colour in water and crystallises in yellowish white shining needles on adding concentrated hydrochloric acid to this solution. With β-naphthol, indazoltriazolene forms indazolyl-azo-β-naphthol—



which crystallizes in red silky matted needles melting at about 250° C. The dyestuff differs from ordinary β-naphthol dyestuffs in its solubility in caustic soda lye. On heating with certain solvents, the compound is converted into a lighter coloured product. This reaction is described in the abstract which follows. The dyestuff from indazoltriazolene and dimethy-laniline forms orange yellow needles melting at 257° C. Dimethylindazoltriazolene obtained from dimethyl-Iz-amido-indazol (from diazomesidine) by the method already given, forms golden yellow silky needles melting at 81° C unstable to light. The substance shows similar reactions to indazol-triazolene and combines with β-naphthol to form dimethylindazolyl-β-naphthol—



crystallising in small reddish-brown needles with a greenish reflex and melting at 267° C. Methyl-amido-indazol from diazotised asymmetrical xylidine when diazotised and treated with potassium acetate gives methylindazoltriazolene

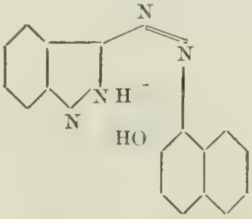


which forms yellow rectangular plates melting at 106° C. and possesses all the characteristics of its lower homologue.

—T. A. L.

β-Naphthol-Azo-dyestuffs, Dehydration of. E. Bamberger Ber. **32,** [10], 1797—1802.

In the course of the previous investigation it was noticed that when indazolyl-azo-β-naphthol was recrystallised from amyl alcohol it became lighter in colour, and was converted into a substance containing one molecule of water less. The reaction taking place may be represented as follows:—



and can also be effected by heating the azo compound with various other solvents, *e.g.* boiling with glacial acetic acid, heating with water to 165° C. for eight hours, with chloroform to 135° C. or with alcohol to 140° C. for the same time. The azohydrocarbon so obtained, melts without decomposition at 249° C., and crystallises from hot amyl alcohol in golden yellow silky matted needles readily soluble in hot chloroform and xylene, sparingly soluble in hot alcohol, acetone, and petroleum ether. The product dissolves in concentrated sulphuric acid and fuming hydrochloric acid, with a magenta colour and separates from these solutions, on adding water, as a yellow flocculent precipitate. It dissolves in benzene, toluene, and xylene, with a yellowish-green fluorescence, and is insoluble in alkalis. In a similar manner dimethylindazolyl-azo-β-naphthol on boiling with 75 times its weight of glacial acetic acid for 45 minutes, forms orange-yellow matted needles, melting at 267° C. without decomposition. Concentrated sulphuric acid gives a bluish-violet solution which, on adding water, turns bluish-red, and then precipitates the yellow anhydride. The reaction is peculiar to the indazolyl-azo-β-naphthol dyestuffs, and an attempt to obtain a closed anhydride from phenyl-azo-β-naphthol was unsuccessful.—T. A. L.

Basic Dyestuffs with Acid Dyestuffs, Precipitation of. E. Bänziger and L. E. Vlies. J. Soc. Dyers and Col. 1899, **15,** 6, 148—151.

The authors have examined the precipitates which are formed on mixing aqueous solutions of basic and acid dyestuffs.

From Chrysophenine (1 mol.) and Victoria Blue B. (2 mols.) a sparingly soluble precipitate is obtained, which is readily decomposed by acids and alkalis. A solution of sodium stearate, on heating, converts it into Chrysophenine and the stearic acid salt of the Blue. The same action takes place on the fibre, the basic colour being removed by a boiling solution of soap, leaving on the fibre the acid colour. The stearic and carbonic acid salts of Victoria Blue B. do not react in alcoholic solution with Chrysophenine.

The precipitate, obtained from the aqueous solutions of the two dyestuffs, is free from chlorine and contains sodium, but less of this than it would do if the compounds reacted in equi-molecular proportions. It would appear, therefore, that the product is not homogeneous.

Other dyestuffs used in the investigation were Benzopurpurin 4 B. (1 mol.) and Magenta (2 mols.); Methylene Blue (2 mols.) and Benzopurpurin 4 B. (1 mol.); Diamine Blue (1 mol.) and Magenta (4 mols.) and Tartrazin (1 mol.) and Magenta (4 mols.). The precipitates from these, all contain sodium and are free from chlorine. They dissolve in concentrated sulphuric acid with colours corresponding with those of their component dyestuffs: thus, that from Benzopurpurin 4 B. and Magenta dissolves with a green colour, the former dyestuff giving a blue and the latter a yellow colour.

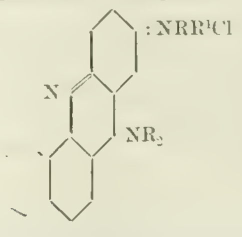
Magenta picrate, which may be obtained by adding a solution of picric acid to one of Magenta, is decomposed by filter-paper and by cotton mordanted with tannic acid. The latter absorbs the Magenta and leaves the picric acid in solution.

In the discussion which followed the reading of the paper, E. Knecht explained that the discovery of the "topping" with Malachite Green of cotton dyed with Chrysamine, attributed to him (see this Journal, 1886, 532; and 1887, 817), had been communicated to him. He, however, had gone into the subject, and had found that the action was a general one between the classes of dyestuffs of which those mentioned are members.—E. B.

PATENTS.

Aposafranines, Manufacture of Sulpho-Acids of. J. Imray, London. From The Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany. Eng. Pat. 14,962, July 7, 1898.

Aposafranines represented by the general formula—



when acted on by normal or acid salts of sulphurous acid, form addition compounds, which, on heating, are converted into leuco-compounds, and these are oxidised by the air to new aposafranine sulphonic acids. It is most probable that the sulphonic acid enters para to the azine nitrogen. The shades produced by the new products on wool from an acid bath are similar to those given by the unsulphonated products. The sulphonic acid group may be readily removed by the action of alkalis or primary amines, giving safraninones and safranines. The following is an example of the method by which the new sulphonic acids are produced. A solution of Neutral Blue in 10 times its weight of water is mixed with one part by weight of sodium bisulphite. The solution is heated on the water bath, when it turns yellowish-brown, and a precipitate begins to separate. The new sulphonic acid of the dyestuff may be completely precipitated by adding hydrochloric acid.—T. A. L.

Nitro Derivatives [Violet, Violet Black] of the Anthracene Series, The Manufacture or Production of New. H. E. Newton, London. From The Farbenfabriken vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 16,034, July 22, 1898.

According to Eng. Pat. 23,927 of 1894, and 4961 of 1895 (this Journal, 1895, 1041; 1896, 194), valuable condensation products are obtained from one molecular proportion of purpurin and one or two molecular proportions of an aromatic amine. The patentees now find that these condensation products or their sulphonic acids when treated with nitric acid, with or without the presence of boric acid, yield nitro derivatives of high technical value. When heated with sulphuric acid (30° B.) these nitro-products are decomposed, regenerating purpurin. The following is a typical example. A solution of 10 kilos. of purpurin monoanilide in 100 kilos. of concentrated sulphuric acid (66° B.) is heated to 50°—60° C. until sulphonated. The melt is then cooled to 15° C. and 9·5 litres of nitrosulphuric acid (containing 1·9 kilos. of HNO_3) are gradually added at a temperature not exceeding 20° C. After stirring for one hour, the melt is poured into 1,000 litres of water, when the dyestuff precipitates in brown flakes. It dissolves in hot water, gives a red solution with caustic soda lye, and dyes chrome mordanted wool fast violet to violet-black shades.
—T. A. L.

Indigo, A New Process for the Production of. H. E. Newton, London. From The Farbenfabriken vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 16,201, July 25, 1898.

Phenylglycine-*o*-carboxylic acid or its acetyl derivative is mixed with three times its weight of absolute alcohol and saturated in the cold with gaseous hydrochloric acid. After standing about 12 hours the mixture is heated on the water-bath, and subsequently the excess of alcohol is distilled off. The residue which solidifies is, if necessary, treated with sodium carbonate solution to remove any acid ester present, and the neutral ester separates from an ethereal solution in glassy crystals. In order to convert this product into indigo, equal parts of it and of dry powdered caustic potash are mixed and heated on the water-bath. The mass turns yellow, and subsequently an energetic reaction commences, alcohol distilling off. The melt, when cool, is diluted with water, and forms a yellowish liquid which deposits indigo in good yield when air is passed through the solution.
—T. A. L.

Disazo Colouring Matters, The Manufacture or Production of. H. E. Newton, London. From The Farbenfabriken vorm. F. Bayer and Co., Elberfeld. Eng. Pat. 18,572, Aug. 30, 1898.

The patentees combine the diazo derivative of an acidyl-1.4-naphthylenediamine with Cleve's 1.3′- or 1.2′-naphthylamine sulphonic acid, diazotise the amido-azo compound so produced, combine this with α-naphthol sulphonic acid, and finally split off the acidyl group. The product obtained, is different from that formed according to Fr. Pat. 232,299 of 1893, and has more valuable properties. The diazo compound from 23·7 kilos. of acetyl-*p*-naphthylenediamine, 20 kilos. of hydrochloric acid (23 per cent. HCl) and 7 kilos. of sodium nitrite is run into a solution, cooled to 10° C., containing 27 kilos. of sodium 1.3′-naphthylamine sulphonate and 20 kilos. of crystallised sodium acetate in 500 litres of water. After stirring for a short time, 30 kilos. of soda lye (33 per cent.) and 11 kilos. of sodium nitrite are added. The resulting solution is mixed with 110 kilos. of hydrochloric acid (23 per cent. HCl) and, after stirring for six hours, the diazo compound is filtered off, mixed with 300 litres of water, and poured into 500 litres of ice-cold water containing 35·35 kilos. of sodium carbonate and 25 kilos. of 2·3′-naphthol sodium sulphonate. After salting out, the dyestuff is filter-pressed, dissolved in 1,000 litres of water mixed with 150 kilos. of soda lye (33 per cent. NaOH) and boiled for a short time. Finally, 180 kilos. of salt and 80 kilos. of hydrochloric acid are added, and the precipitated dyestuff is filter-pressed, dried, and powdered. The new dyestuff forms a black powder soluble in water, with a bluish-black colour, turning pure blue on adding strong soda lye or acetic acid. It is insoluble in hydrochloric acid, but dissolves in concentrated sulphuric acid with a pure blue colour, from which it can be separated as a flaky blue precipitate by adding ice. It dyes unmordanted cotton blue, and can be diazotised on the fibre, and when developed with β-naphthol gives indigo blue shades fast to acids, alkalis, washing and light. Similar products can be obtained if the 2.3′-naphthol sulphonic acid be replaced by the 1.4-naphthol sulphonic acids or by the 2.3.3′-naphthol disulphonic acid.—T. A. L.

Blue Dye-Stuffs for Cotton ; The Manufacture or Production of. H. E. Newton, London. From The Farbenfabriken vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 16,737, Sept. 1, 1898.

The process herein described, is supplementary to that of Eng. Pat. 17,018 of 1897 (this Journal, 1898, 754.) The present application consists in heating with sulphur and alkaline sulphides 1.1.′-chloronaphthol sulphonic acids or the azo dyestuffs derived from diazo compounds and 1.1′-amidonaphthol sulphonic acids. For example, 50 kilos. of 1.1′.4.2-chloronaphthol disulphonic acid are stirred into 15 litres of soda lye (40° B.), and after adding 81 kilos. of dry sodium sulphide and 75 kilos. of flowers of sulphur, the mixture is heated in an iron vessel with constant agitation to 200° C., until it becomes dry. The vessel is then closed, the temperature is raised to 240 C. and maintained thereat for 4 – 5 hours, until the melt dissolves in water with a pure blue colour and no increase in intensity takes place. After cooling, the melt is repeatedly extracted with small quantities of hot water, and the dyestuff is separated from the combined filtrates by adding zinc chloride. The product so obtained, dyes cotton from a boiling bath containing a reducing agent (glucose and sodium carbonate or alkali sulphide, &c.), or from a cold bath containing alkali sulphides, brownish shades which turn indigo blue shades, fast to alkalis and light. The less soluble portion obtained as above gives brown shades from a bath containing alkali sulphides.—T. A. L.

Blue-Black Colouring Matters ; Impts. in the Manufacture of. R. Holliday and Sons, Ltd., J. Turner, and H. Dean, Huddersfield. Eng. Pat. 17,740, Aug. 17, 1898.

When *p*-amidophenol is heated with sulphur at temperatures from 150°—250° C., dyestuffs for animal and vegetable fibres are obtained, varying from reddish to greenish blue, according to the proportion of sulphur employed. The higher the temperature, and the larger the proportion of sulphur, the more insoluble are the products, but by heating to 140°—200° C. with caustic alkali or alkali sulphides, with or without the addition of sulphur, they may be made soluble. Dyestuffs are also obtained by heating together equi-molecular proportions of *p*-amidophenol and the *p*-sulphonic acids of phenol, cresol, naphthol, or *o*-toluidine, the nitroso-derivatives of phenol, cresol, α- and β-naphthol, dioxynaphthalenes, and amidoazobenzene or amidoazotoluene. If the products so obtained are heated at 150°—200° C. with 5 parts of sodium sulphide and 0·75 part of sulphur, dyestuffs are produced which dye vegetable fibres black. For example, 100 kilos. of *p*-amidophenol and 200 kilos. of sulphur are heated to 150°—170° C. for a few hours. The dyestuff so produced dissolves in caustic alkalis and alkali sulphides, with a deep blue colour. If 10 kilos. of this product, 25 kilos. of caustic soda, and 5 kilos. of sulphur be heated together at 180° C., until the melt becomes solid, the dyestuff obtained, gives black shades on vegetable fibres. By heating 109 kilos. of *p*-amidophenol and 173 kilos. of nitroso-α-naphthol to 160° C. for a few hours, a dyestuff is obtained which dissolves in alkalis with a violet-black colour.—T. A. L.

Azo-colouring Matters, The Manufacture and Production of New Substantive. J. Y. Johnson, London. From The Badische Anilin and Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 18,506, August 29, 1898.

The specification refers to new dyestuffs obtained from products described in Eng. Pats. 14,678 and 21,753 of 1893 (this Journal, 1894, 724 and 1054) and Eng. Pat. 8564 of 1894 (this Journal, 1895, 266) the new products described are mixed diazo dyestuffs obtained by combining a tetrazo compound with *m*-phenylene diamine disulphonic acid and then with a nitro-*m*-diamine. No process is known for obtaining directly an intermediate compound from a tetrazo derivative and *m*-phenylene diamine itself whilst this reaction proceeds smoothly in the case of the disulphonic acid. For example the tetrazodiphenyl chloride solution from 94 kilos. of benzidine, 345 kilos. of hydrochloric acid (28 per cent. HCl) and 70 kilos. of sodium nitrite, is cooled with ice and made alkaline with soda. Into this solution is run an aqueous solution of 156 kilos. of sodium *m*-phenylene diamine disulphonate, the whole being stirred for about 6 hours. The reddish-brown intermediate product is filtered off, stirred to a thin paste with water and added to a solution of 80 kilos. of nitro-*m*-phenylene diamine in 30,000 litres of water at about 45° C. This temperature is maintained with constant agitation for about 12 hours when it is raised to 90° C. Soda is then added till alkaline and the dyestuff is precipitated with salt. After cooling, it is filter-pressed and dried. The new dyestuffs are slightly soluble in cold water, more so in hot. They dye unmordanted cotton brilliant shades fast to washing, acids, and light. The solutions are orange coloured, unaltered by caustic soda, but precipitated by mineral acids.—T. A. L.

Colouring Matters [Black], Impts. in the Production of. A. Ashworth and J. Bürger, Bury. Eng. Pat. 8083, April 18, 1899.

Black and brown dyestuffs for vegetable fibres from an alkaline bath, are obtained by treating with caustic soda lye and sulphur the products formed in Liebermann's reaction by acting with nitrosophenols on phenols in presence of sulphuric acid. A mixture of 10 lb. of *p*-nitrosophenol, 40 lb. of phenol, and 20 lb. of concentrated sulphuric acid is allowed to react. The melt has then added to it 100 lb. of caustic soda lye (80° Tw.), and 30 lb. of finely ground sulphur, the whole being heated to 180° C. until the reaction is complete. The blackish mass obtained, is soluble in water and the dyestuff can be precipitated from the aqueous solution by mineral acids. It dyes greenish-blacks on vegetable fibres from an alkaline bath, which, on oxidation with sodium bichromate and sulphuric acid or similar oxidising agents, are converted into fast deep blacks. If the phenol be replaced by commercial cresol in the above example, the resulting dyestuff gives brown shades on vegetable fibres.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Benzine (Petroleum Spirit) and Carbon Tetrachloride Question, A Contribution to the. W. Zanker. Leipziger Färber und Zeugdr. Zeit. 1899, **48**, 237.

See under III., *page* 749.

Petroleum Spirit and Cleaning Oils, Inflammability of. Holde and Pelgry. Mitth. k. techn. Versuchsanst. Berlin, **17**, [1 and 2], 68.

See under III., *page* 749.

Benzine, Substitute for. A. Ganswindt. Zeits. angew. Chem. 1899, [23], 537.

See under III., *page* 749.

PATENTS.

Yarns or Threads with Liquids, Impts. in Apparatus for treating. O. Venter, Chemnitz, Saxony. Eng. Pat. 13,124, June 11, 1898.

This invention relates to an "apparatus for treating yarn, such as cops, bobbins, &c., with liquids in an open vessel having the characteristic feature that the regulating float is situated in the interior or axis of the bell-shaped carrier supporting the material to be treated, in order to save space, without increasing the weight or expense," and includes "the combination of a trough having a float situated in the interior of the bell carrying the goods, with a liquid receptacle situated beneath the said trough and connected with the same by a short axial tube, and, if required, with an upward extension of the said tube, to prevent the liquid from falling below a given level."—C. S.

Cotton in the Form of Hanks, Impts. in Apparatus for Mercerising. C. D. Abel, London. From J. Kleinewefers Söhne, Crefeld, Prussia. Eng. Pat. 16,823, Aug. 3, 1898.

The improvement relates to the hank-mercerising process described in Eng. Pat. 7093 of 1897 (this Journal, 1898, 240—241), and consists in "subjecting the hanks, during their treatment with the mercerising fluid, to a mechanical straining action produced by centrifugal force operating on devices that are made to press upon the hanks in an outward direction." For attaining this object, the inventors also claim "the use of centrifugal apparatus wherein either the parts of the centrifugal frame are themselves arranged to move in an outward direction under centrifugal action, or wherein a rigid centrifugal frame has mounted thereon movable parts which move outwards under centrifugal action, or wherein an elastic covering is attached at one point to the rigid centrifugal frame so as to expand outwards under centrifugal action, the said movable parts being in either case caused in expanding to press outwards against the hanks and thereby to subject them to strain."—C. S.

Cotton Yarn, and Apparatus therefor; Impts. in Treating. E. Hantsch, Langenbielau, Saxony. Eng. Pat. 23,428, Nov. 17, 1898.

The process is one of "treating cotton yarn in cops by the forcing in of moist air to render the yarn suitable for further operations"; and the apparatus consists of "a vessel or boiler of suitable construction and provided with rails, on which are placed a number of perforated receptacles which can be inserted or removed through the door of the vessel, in which vessel a current of moist air supplied by an air-compressing pump, moistens the cops placed in the receptacles."—C. S.

Cellulose Tetracetate, Impts. in the Manufacture of. C. O. Weber, C. F. Cross, and I. Frankenburg. Eng. Pat. 18,283, Aug. 25, 1898.

The manufacture of cellulose tetracetate by means of acetyl chloride and magnesium acetate cannot be carried out on a large scale owing to the impossibility of controlling the reaction, the product being injuriously affected by the high temperature developed. The present claim relates to the manufacture of the tetracetate on the large scale in a pure state by combining with the acetylating mixture solvents of the product, such as nitrobenzene or its homologues, including dinitro compounds, epichlorhydrin, or dichlorhydrin for the purpose of restraining and controlling the reactions involved.

For this purpose, suitable proportions of the ingredients, *viz.*, 1·6 lb. of structureless cellulose, 1·4 lb. of magnesium acetate, 1·8 lb. of acetyl chloride, and about 1 lb. of acetic anhydride, are thoroughly incorporated in a kneading machine. When the reaction has fairly started, 1 gall. of solvent (nitrobenzene) is taken and added at first in very small quantities, the successive additions being so regulated that the last and largest portion of solvent is added when the maximum reacting temperature of 70° C. has been reached. A slightly viscid solution of the tetracetate results, which is strained and poured into 5 galls. of alcohol, and the flocculent precipitate is washed and dried, giving a friable product.—J. F. B.

Cellulose Esters, Manufacture of. C. O. Weber, C. F. Cross, and I. Frankenburg. Eng. Pat. 22,029, Oct. 19, 1898.

The inventors claim the manufacture of cellulose esters by mixing structureless cellulose with the zinc or magnesium salt of any of the higher fatty acids, or aromatically substituted fatty acids, and treating this mixture with the "acyl [acidyl] chlorides" and anhydrides of any of these acids. The chlorides and anhydrides employed may or may not be derivatives of the same fatty acids used in combination as zinc or magnesium salts; in the latter case mixed esters are produced. In order to obtain pure and friable products, use is made of the regulating action of solvents of the esters (nitrobenzene, &c., see preceding abstract) when added to the mass during the reaction, to prevent the temperature rising above 70° C.—J. F. B.

Cellulose Films for Photographic and other Purposes, Impts. in the Method and Means for Producing. J. C. Chorley, Warrington. Eng. Pat. 18,697, Sept. 1, 1898.

The method of producing cellulose films of any desired length is claimed, by a continuous operation consisting in supplying "viscose" [cellulose thiocarbonate] in regulated quantities and spreading it evenly and uniformly upon the surface of a slowly rotating heated cylinder, and drying the film of viscose whilst still upon the cylinder, conducting the film away, and treating it with brine to decompose the viscose and regenerate the insoluble cellulose in film form. A machine for this purpose is also claimed. The viscose is fed on to the cylinder from a hopper through a perforated plate and spread in a uniform layer by means of a doctor blade. After about three-quarters of a revolution against a current of heated air, the viscose is dried to a solid film, and is peeled off continuously by a stripping roller, whence it is conveyed to a bath of boiling brine, rendered insoluble, washed, and dried.—J. F. B.

Cellulose, Impts. in the Manufacture of a Felt-like Material from Fibrous. E. Krusche, Russian Poland. Eng. Pat. 8164, April 18, 1899.

The process claimed, consists in partially dissolving fibrous cellulose by means of ammoniated oxide of copper and then precipitating the dissolved cellulose by means of a precipitating substance, so that the remaining fibres are stuck together by the precipitated cellulose into a felt-like material. A thin layer of fibrous cellulose is spread on a copper plate, and the cuprammonium solvent is poured over it. In the semi-dissolved condition the mass is treated by pouring on a 15 per cent. soda or potash lye, and a copper roller is passed over the whole layer. The alkali remaining in the felt is then neutralised by sulphuric acid and the material washed and dried. Sulphuric acid of 12 per cent. may be used instead of soda lye as a precipitating agent.—J. F. B.

Fibre, Banana, Impts. in or relating to the Preparation of. Fr. Szymanski, Berlin. Eng. Pat. 20,807, Oct. 3, 1898.

The fibre is divided into a considerable number of separate filaments, capable of being spun or woven, by a process of clamping the fibre between two or more pairs of bars, each pair of bars being then moved near to the next pair and the material rubbed between them until, by friction and pressure, the filaments are sufficiently separated.—C. S.

Textile Materials and the like, with Liquids; A New or Improved Apparatus for Treating. W. Schmidt, Mülhausen, Germany. Eng. Pat. 4689, March 3, 1899.

In vats for dyeing and otherwise treating textile materials, &c., the inventor claims the use of a perforated false bottom for draining off the liquid, and a discharge nozzle or spout for reconveying the same liquid (by means of a pump) to the surface of the material under treatment. The vat may either be a single chamber, or divided into compartments, or consist of a series of separate vats with a common collecting vessel leading to the discharge pump and nozzles.
—C. S.

Engine Packing, the Manufacture of Dynamite, and other Purposes; An Improved Material suitable for, and Methods of Preparing and Treating same. P. M. Justice, London. From The Marsden Company, Philadelphia, U.S.A. Eng. Pat. 6656, March 28, 1899.

The claims cover a new material adapted for use for packings and other purposes, the same consisting of the comminuted cellular portion of vegetable pith, freed from deleterious and adherent matters; the method of preparing this material from vegetable pith consisting in separating it from the woody and fibrous portions of the shell, and then comminuting the pith and subjecting it to heat and air blasts.

The above product, uniformly charged with a limited proportion of liquid, and, finally, the method of charging it, consisting in first fully saturating the pith and then removing a part of the liquid, are claimed.

The product is said to absorb 35 per cent. more water than pith treated by the older methods, and is eminently suitable as an absorbent for oils, nitroglycerin, &c., and for the manufacture of nitrocellulose or viscose.—J. F. B.

Socks, Belts, Carpet Linings, Bedding, Clothing, Furniture, and for other Purposes; Improved Fabric or Material for Use in the Manufacture of. M. Wilson and G. W. Wood, London. Eng. Pat. 10,521, May 18, 1899.

The fabric for the above purposes consists of paper pulp or felt mixed with the ingredients enumerated below, with or without a disinfecting or deodorising agent. Also a fabric coated with or saturated by the specified ingredients and thickened with a starchy or gelatinous substance, with or without a covering of a light fabric. The ingredients specified, are bruised ginger, ground pepper, borax, boric acid, creosote, cresols, carbolic acid mixed with tar, or the like; camphor may be used as a deodorant.—J. F. B.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Colloidal Salts as Membrane-forming Substances in the Dyeing Process. F. Krafft. Ber. 1899, **32**, [9], 1608. (See also this Journal, 1899, 691 and 692.)

The author, considering that soap solutions under certain conditions of temperature and concentration behave like colloidal solutions, regards their influence in the dyeing and printing processes from a new point of view. All substances used for mordanting belong to the class of colloïds, and in the great majority of cases dyeing is simply a precipitation of colloidal (gelatinous and resistant) salts upon or within the fibre. This statement indicates the direction in which to work in order to find an explanation for the part played, for instance, by Turkey-red oil. Soaps and other colloïds exhibit their colloidal, membrane-forming properties not only in the soluble, but in the insoluble state. When precipitated from solution, they do not present an amorphous character, but are "globomorphous," *i.e.*, they exhibit microscopic, but very regular, spheroidal forms. They may be compressed easily into very thin, elastic membranes, adhering firmly to the surface of solid bodies.

Dyestuffs, with low molecular weights, possess the colloidal character, if at all, only in a slight degree. To produce proper colorations on the fibre, they require to be converted into colloidal compounds by means of colloidal fixing agents. For basic colours, soaps and tannic acid are principally in use, whilst for acid dyestuffs metallic mordants are employed, such as the hydroxides of iron, chromium, aluminium, and tin, substances that are globomorphous and the colloidal character of which has been already recognised by Graham (Ann. Chem. Pharm. **121**, 1). This latter group contrasts with the high molecular, direct-dyeing cotton azo colours, which are colloïds either slightly soluble in water or swelling when in contact with it.

To substantiate the above views, A. Strutz, W. Hofmann, and G. Prenner have performed a series of experiments. By the ebullioscopic method applied in alcoholic solution to Magenta, Methyl Violet, and Methylene Blue, values very near to their molecular weights were found, whilst in aqueous solution the molecular weights were found considerably too high, pointing to a tendency, at least, of these dyestuffs to assume the colloidal character. Tannic acid proved to be a very perfect colloïd. If colloidal acids and bases combine, the resulting products are, as a rule, also colloidal. This was demonstrated in the case of the palmitates and oleates of Fe, Al, Cr, Sn, and the precipitate formed by tannic acid and tartar emetic. All these compounds are pliable and in a high degree exhibit a gelatinous colloidal character.

If colloidal fixing agents, such as tannic acid and soap, or even lower acids, like caproic and lauric acids, meet with basic dyestuffs, again the formation of colloïds will be observed. It is well known that in alizarin dyeing both the metallic mordant and a fatty acid are necessary to secure good and fast dyeing. It was found that with the mordant alone, or with the fatty acid alone, the alizarin gave only amorphous products without gelatinous properties, and the colloidal nature remained undeveloped till both had been used simultaneously. The above-mentioned direct (substantive) cotton dyestuffs are not only able, in consequence of their colloidal properties, to form "dry membranes" on cotton, but also "damp molecular membranes" (resembling in character soap bubbles) and slimy gelatinous products, under certain conditions.

The processes of wool and silk dyeing depend in the same way on the formation of colloidal substances, the fibre in these cases taking part in the production of such compounds.

It is probable that colloïds play also a prominent part in the preparation of leather.—S. K.

Indigo Vat, the Zinc-Dust. A. Binz and F. Rung. Zeits. angew. Chem. 1899, [21], 489—494 and 515—520.

Zinc dust came into use as a reducing agent for Indigo shortly after its manufacture by Stahlschmidt. It is chiefly employed along with lime, on account of the protection from oxidation afforded to the reduced Indigo by the pellicle of calcium carbonate which forms on the surface of the vat, a vat prepared with caustic soda quickly becoming useless from oxidation.

Notwithstanding the fact that the zinc vat is probably, at the present time, the vat which is most largely employed, the best proportions of the materials to be taken for setting it are not definitely known. Those recommended by different authorities vary greatly; thus, from 2·5 to 10 parts of zinc and from 5 to 50 parts of lime for 10 parts of Indigo are given. The time required for oxidation is also variously fixed at from eight hours to five days. Further, the usual practice of allowing the action to take place at the ordinary temperature is occasionally departed from.

The extent of reduction is also a point on which uncertainty prevails. Although analytical results have not been published, the opinion is held (see Grossmann, this Journal, 1898, 1109) that over-reduction, with loss of dyestuff as a consequence, takes place in the zinc-dust vat, as it does when the reduction is effected, with the aid of heat, by glucose (Schunck, Phil. Mag. **4**, 30, 293), and at the ordinary temperature with electrolytically liberated hydrogen and zinc (Binz, this Journal, 1898, 1141; Binz and Rung, this Journal, 1898, 1143).

Again, the question whether lime has any precipitating action on Indigo White, is undecided. Berzelius (Lehrbuch der Chem. **7**, 209), on the one hand, basing his opinion on the formation of an insoluble yellow-coloured compound when a solution of Indigo White is digested with milk of lime, inferred that lime has such an action. On the other hand, Schützenberger (Traité des Mat. Col. **2**, 574), from his experience with the lime and ferrous sulphate vat, came to an opposite conclusion.

The authors have therefore undertaken an investigation with the object of determining—

1. The proportions of zinc, lime, and Indigo, the temperature and the duration of action which give the greatest yield of Indigo White.

2. The circumstances under which, and the extent to which, over-reduction of Indigotin occurs.

3. The composition of the calcium Leuco-indigotin compound in solution in the vat.

Experiments were first made with zinc, caustic soda, and "Indigo pure" (B.A.S.F.) in paste. A sample of this was dried, and in this condition was found to contain 97·9 per cent. of Indigotin, the paste containing exactly 20 per cent. of Indigotin. The results are given in the table on page 758.

From these results it appears that complete reduction takes place in about 48 hours, and that a good yield of Indigo White may be obtained, but not the theoretical yield. It is interesting that an increase in the proportion of either zinc or caustic soda is attended by an increase in the amount of Indigo White formed, but that little or no difference in the latter, results from a simultaneous large increase in the proportion of both zinc and caustic soda.

Vats Nos. 11 to 17 are of the same concentration as those employed in practice. It will be observed that the yield of Indigo White in them in no case exceeds 91 per cent.

No. of Vat.	Indigotin.	Zinc Powder with 72 per Cent. of Zn.	Caustic Soda.	Duration of Action.	Indigo White formed, in Terms of Indigotin.
	With Water to 100 c.c.				
	Grms.	Grms.	Grms.	Hours.	Per Cent.
1	3·23	2	4	48	78·0
2	3·23	3	2	6 48	43·0 88·9
3	3·23	3	3	6 18	51·5 93·9
4	3·12	3	3	90	96·4
5	3·12	3	3	110	97·3
6	3·23	3	4	18	94·8
7	3·23	3	6	216	97·6
8	3·23	3	3	6 18	63·7 95·6
9	3·12	5	3	18	97·1
10	3·11	6	6	48	96·8
11	0·272	0·3	0·8	26	74·4
12	0·272	0·3	0·8	72	82·7
13	0·272	0·5	0·8	24	85·2
14	0·272	0·6	0·8	72	86·3
15	0·272	0·6	4·0	72	90·4
16	0·272	1·5	0·8	72	89·9
17	0·272	1·5	4·0	48	90·6

A fact concerning the reduction of indigo which appears hitherto to have escaped observation, is that, whilst in a mixture of zinc dust, finely ground Indigo, and water, the Indigo remains in suspension for a long time, it subsides at once on the addition of a small amount of alkali. This has an important bearing on the reduction of Indigo by zinc in the presence of alkalis. The authors find it to be essential for the metal and dyestuff to be brought into immediate contact, a circumstance which points to the probability of the first phase of the reaction being a direct union of the two substances according to the scheme :

$$C_{16}H_{10}N_2O_2 \xrightarrow{Zn} C_{16}H_{10}ZnN_2O_2 \xrightarrow{2NaOH} C_{16}H_{10}Na_2N_2O_2 + Zn(OH)_2$$

This theory finds support in the fact that a mixture of zinc powder, caustic soda, and water, in the proportions employed to reduce Indigo, and in the time necessary for this, evolves less hydrogen than would theoretically be required for the reduction of the amount of Indigo which the mixture is capable of acting upon: thus, a mixture of 3 grms. of zinc powder and 2 grms. of caustic soda, with water to make 100 c.c., evolved at the ordinary temperature in 6 hours 3·4 c.c. of hydrogen, whilst a similar mixture in the presence of Indigos (Vat No. 2 foregoing table) under the same conditions, reduced an amount of the latter corresponding with the formation of 118 c.c. of hydrogen.

Sodium amalgam has very little action on Indigo at the ordinary temperature, and only on those particles with which it is brought into contact. On heating, it reduces the dyestuff.

Some results obtained in experiments made with zinc and lime, in place of zinc and caustic soda, as reducing agents for Indigo, are tabulated below :—

No. of Vat.	Indigotin.	Zinc Powder containing 72 Per Cent. of Zn.	Lime (CaO).	Duration of Action.	Indigo White formed, in Terms of Indigotin.
	With Water to 100 c.c.				
	Grms.	Grms.	Grms.	Hours.	Per Cent.
18	3·34	3	3	48	78·4
19	3·34	3	6	24	44·3
20	3·34	3	12	48	43·4
21	3·34	6	3	48	88·5
22	3·34	6	6	24 48	90·2 91·0
23	3·34	12	3	48	89·7
24	0·255	0·64	0·7	18 120	62·6 64·9
25	0·255	0·61	0·5	48	65·2
26	0·266	0·30	1	52	79·4
27	0·266	0·67	1	72	85·9
28	0·266	0·67	2	72	86·1

The yield of Indigo White, it will be seen, is in no instance so high as it is with caustic soda and zinc. With an increase in the proportion of lime alone, a smaller quantity of Indigo is acted upon, but with an increase in the proportions of both lime and zinc, a larger quantity of the dyestuff is reduced. Undissolved lime hinders the action mechanically.

An insoluble basic lime compound of Indigo White does not exist.

A solution of the calcium compound of Indigo White at 80° C. deposits yellow flocks, which settle rapidly. A solution containing 0·289 grm. of Indigo White in 10 c.c., after being heated at 98° C. for half an hour, contained 0·272 grm. of that compound in the same volume.

It would appear that a mixture of neutral and acid calcium-Indigo White compounds, exists in solution in the lime-zinc vat, the lime (CaO) and Indigo White being present in the ratio of from 12·3 to 20·7 parts to 100 parts. The neutral compound requires 21 parts and 100 parts respectively.

Over-reduction.—The yield of Indigo White is adversely affected by heating the mixture of alkali, zinc, and Indigo, and prolonging the action; thus, a caustic soda-zinc mixture, after ¼ hour's heating at 97° C., gave a yield of 94·7 per cent., but only 74·8 per cent. after 2 hours' heating at the same temperature. Similarly, a lime-zinc mixture which was heated for 2½ hours at 40° C. gave 88·6 per cent., whilst a portion of it which was heated for 1½ hours at 80° C., gave 77·4 per cent.

A solution in which over-reduction has taken place, when oxidised and filtered, gives a filtrate which, after it has been acidified, decolorises potassium permanganate. Schönbein (J. prakt. Chem. **18**, 16) observed that the filtrate from an oxidised Indigo vat has this action, and concluded that it contained hydrogen peroxide. There appears to be no relation between the amount of Indigotin destroyed by over-reduction and the amount of potassium permanganate required to colour the filtrates.

Sodium stannite was found by Crighton and one of the authors to have practically no over-reducing action on Indigo White.

The authors express the opinion that greater losses through over-reduction are likely to take place in practice with unrefined natural Indigo than with pure Indigotin.

—E. B.

Quebracho-Tannin as Mordant-Dyestuff for Wool.

C. Dreher. Färber-Zeit. **10**, [12], 190—191; [13], 209.

The recently-introduced Quebracho has so far been exclusively employed in the tannery, where, on account of its cheapness, it competes seriously with oak bark. It comes into the market in the form of wood containing 20—24 per cent. of tannic acid; and also as dry extract containing 60—70 per cent. of tannic acid.

The tannin-substance of Quebracho is not identical with other known tannins, and is, moreover with difficulty soluble in water, the solution having a deep reddish colour. However, the solubility is increased by such additions as sodium bisulphite, borax, or sodium phosphate, and the red colour is greatly diminished by mixing the Quebracho with other tannins.

Although in dyeing, Quebracho will probably never compete directly with tannic acid, since its combinations with metallic oxides are too strongly coloured, yet it might advantageously replace sumach, and especially catechu, in the production of dark colours, for the weighting of silk, &c. Quebracho dyes a brown on cotton similar to that obtained with catechu, but it is deeper, and can be produced at half the cost; on this account, therefore, it might well replace catechu in cotton dyeing.

The author noticed that, on adding chromic acid to a solution of Quebracho, a brown precipitate was produced which was insoluble in water and even in strong alkali.

In an endeavour to fix this brown insoluble body on the wool fibre, he obtained a full natural brown shade of extraordinary fastness to washing and milling; moreover, the wool had a soft handle, whilst a sample dyed with catechu had quite a harsh feel.

The dyeing process was performed as follows :—100 grms. of Quebracho extract were dissolved in 40 litres of boiling ater and 80 grms. of sodium chloride added to the hot olution; 1 kilo. of woollen yarn was handled in this olution for one hour during gentle boiling.

The yarn was then taken out, allowed to drain, treated or $\frac{1}{4}$ hour in a fresh bath at 80° C. with 3 per cent. f potassium bichromate and 1 per cent. of sulphuric acid, nd finally rinsed and dried.

The strength of shade corresponds to that given with per cent. of Anthracene Brown powder or $1\frac{1}{2}$ per cent. of Chromogen."

The author thinks that when the process of dyeing is nproved and cheapened, the brown so produced will eplace similar shades now obtained with wood or alizarin yestuffs on chromium mordant.

Further observations led to the conclusion that Quebracho onsists of a mixture of two or more species of tannin, ne of which dyes more strongly than the other, on a hromic acid mordant. These might possibly be with dvantage separated into two portions, one portion being tilised for dyeing and the other for tanning.—J. E. H.

inc Chloride on Cotton [Calico Printing], Action of. R. J. Flintoff. J. Soc. Dyers and Col. 1899, **15**, 6, 151—156.

OME printed calico which was steamed between folds of nbleached calico, containing zinc chloride in places here and nere, became "tendered" wherever the salt had been in ontact with or close proximity to it. In the case of the rinted calico, the injury was found to be due to hydrohloric acid, disengaged from the salt, whilst, in the case of he unbleached calico, the damage to the fibre was caused y the direct action of the basic zinc chloride which was roduced in steaming. The affected parts, in the latter ase, had the appearance of mercerised cotton.

A solution of zinc chloride, containing 10—20 grms. per tre, has no perceptible action on cotton in steaming. The ction begins to be appreciable with a solution containing 00 grms. of the salt per litre.

Tartaric, citric, and oxalic acids have the power of comletely displacing hydrochloric acid from zinc chloride under he influence of steam. Hence samples of calico impregated with solutions of zinc chloride to which these acids re added in amounts sufficient to displace the hydrochloric cid, become much more acted upon in steaming, than are amples impregnated with similar solutions of zinc chloride lone, and they show, moreover, no appearance of nercerisation.

Hydrochloric acid is evolved on boiling solutions of the hlorides of zinc, magnesium, barium, and sodium, to which ne of the above acids is added.—E. B.

PATENT.

leaching Linen, Cotton, and other Articles, Process for the Production of a Substance for. H. Wächter, Bielefeld, Germany. Eng. Pat. 3431, Feb. 16, 1899.

TATED proportions of soda, caustic lime, and water, with r without salt, are heated with a small proportion of owdered zinc, iron or tin, a small proportion of potato tarch being added after boiling the mixture for several ours, to form a beaching paste.—E. S.

VII.—ACIDS, ALKALIS, AND SALTS.

odium Bicarbonate, Liberation of Carbon Dioxide from, by Heat. C. S. Dyer. Pharm. J. 1899, **63**, [1518], 96. Read before the British Pharm. Conference.

HE author refers to Cowie's experiments (this Journal, 899, 393) and states that finding traces of carbon dioxide y a delicate test on exposing a bicarbonate to a temperature f about 55° C., is, in his opinion, not sufficient ground for eclaring that the salt decomposes at that temperature to ny practical extent, and that probably the traces of carbon ioxide merely came over with the small amount of moisture sually present.

At temperatures below 100° C., dry sodium bicarbonate ecomposes slowly; below 60° C., scarcely at all; and above 20° C., with decided rapidity.—A. S.

Electrolytic Chlorate Works, Chedde, Savoy. J. B. C. Kershaw. Eng. and Mining J. **67**, 677—679.

IN 1889 the first electrolytic chlorate factory was started at Villers-sur-Hermes, in Switzerland. In 1898, there were seven electrolytic chlorate factories in operation, utilising 30,000 h.p., and producing 6,500 tons chlorate per annum, or more than one half of the total production.

The Chedde Works use the process and apparatus covered by the French Pats. 226,257 of 1892 and 238,612 of 1894, and granted to M. Paul Corbin.

The works utilise the power of the River Arve, and produce about 3,000 tons of chlorate per annum. The hydraulic and other works were commenced in June 1895, and the factory was put into operation in July 1896. The hydraulic works comprise a dam near the bridge of Servoz, in the valley of Chamounix, 1,790 metres of pipe lines, galleries, and tunnels; and a bridge over the River Arve at Chedde for carrying the water into the turbine house.

The head of water at Chedde is 140 metres, and a maximum of 12,000 h.p. can be obtained when the Arve is in flood. The power house contains twelve 1,000 h.p. turbines, direct coupled to 12 Oerlikon continuous current dynamos, each capable of yielding 830 E.H.P.

The decomposing vats are contained in a building 130 metres long by 60 metres wide, by $21\frac{1}{2}$ metres high; the whole works covers an area of 13,000 sq. metres.

The decomposing vats are of cement, and contain a large number of secondary electrodes, the manner in which these are mounted and arranged in the vats, forming the chief claim of the Corbin patents. The material used is thin platinum foil. A detailed description of these vats and electrodes, illustrated by figures, is given in the original article. Notes upon the theory of the process, and references to the investigations of Oettel and other experimenters, as to the best conditions for obtaining a high yield of chlorate, follow. The article closes with a table of efficiencies of various processes, and an estimate of the cost of electrolytic chlorate. This works out to 5·59 cents per lb., taking the E.H.P. hour at $\frac{1}{5}$ cent., or $\frac{1}{10}$*d.*—J. B. C. K.

Ammonium Perchlorate, Preparation from Sodium Perchlorate and Ammonium Nitrate of. U. Alvisi. (Ger. Pat. 103,993.) From Zeits. angew. Chem. 1899 [23], 551.

A CONCENTRATED solution of sodium perchlorate (213 parts) is treated with ammonium nitrate, or a strong solution thereof (75—77 parts). Ammonium perchlorate is precipitated in the form of small crystals, which are treated in a hydro-extractor or pressed, and then recrystallised. —S. K.

Iron [Ice Machines], Action of Liquid Sulphurous Acid on. A. Lange. Woch. für Brau. 1899, **16**, [27], 357—359. See also this Journal, 1899, 492.

THE author has investigated the action of liquefied sulphurous acid on metals and draws the following conclusions:—

(1.) Sulphurous acid containing water, attacks metals, particularly iron, if the temperature rise above a certain degree—about 70° C. The temperature at which action begins is higher the purer the acid is. Absolutely anhydrous acid does not, as a rule, attack iron at temperatures up to 100° C.

(2.) In ice machines worked by sulphurous acid, the cooling of the cylinder and piston protects these parts from the action of the acid.

(3.) In the condenser the sulphurous acid undergoes purification so long as the machine is sufficiently filled, and the water from the upper part of the condenser is removed as occasion arises.

(4.) In order to avoid any action on the valves, it is recommended to work with the compressor not quite dry, that is, to keep the temperature at this place below 70° C. —A. S.

Nitric Acid, Preparation of Fuming. L. Vanino. Ber. 1899, **32**, [9], 1392—1393.

THE commercial solution of formaldehyde is readily oxidised by cold, concentrated nitric acid, nitrogen peroxide being evolved. To prepare the fuming acid by this means paraformaldehyde or "formalith" (kieselgubr impregnated with polymers of formaldehyde) is added to the cold, concentrated acid in small quantities at a time. The aldehyde is completely destroyed, and large quantities of nitrogen peroxide remain dissolved in the acid. The reaction is much retarded by chlorine and completely prevented by hydrogen peroxide.—T. E.

Chromic Acetate. A. Recoura. Comptes Rend. **129** [3], 158—161.

Like other chromic salts (this Journal, 1898, 348) the acetate exists in isomeric modifications. Freshly prepared by precipitation of the sulphate with barium acetate, it yields a green solution, from which the solid compound $Cr(C_2H_3O_2)_3.5H_2O$ can be isolated. The chromium in this salt is completely precipitated by the calculated amount of sodium hydroxide. This acetate is completely decomposed by the calculated amount of sulphuric acid, and is proved to be the normal salt. It can be obtained by dissolving freshly precipitated chromium hydroxide in the calculated quantity of acetic acid. It is unstable, the green solution changing into violet; when this change is complete, in about two hours, alkalis no longer precipitate it. When this stage is reached one of the three acetyl groups is no longer present as an electro-positive ion, but forms part of a stable compound or "radicle" with the chromium. The author has distinguished two further phases of the change, in which respectively two, and all three of the acetyl groups are so combined.—J. T. D.

Double Salts, Contributions to our Knowledge of Aqueous Solutions of.—II. Chlorides. H. C. Jones and Kenjiro Ota. Amer. Chem. J. 1899, **22**, [1], 5.

See under XXIV., *page* 791.

PATENTS.

Carbonic Anhydride, Solid, An Apparatus whereby it can be converted into the Liquid Form and thus Stored. A. F. Watson, Dublin. Eng. Pat. 13,496, June 17, 1898.

The apparatus is "a steel cylinder fitted with a cap attached by means of screws with buttress or other threads, and a valve, and rendered gas tight by means of a washer of metal or rubber or gutta percha, kept in its place by a collar," which has two arms turning in fixed supports, so that the cylinder may be inclined from the vertical to the horizontal position, for facility of washing out. The solid carbonic anhydride is shovelled into the open cylinder, the cap is screwed on by hand, and tightened by means of a spanner and handle. The cylinder is then allowed to come to the atmospheric temperature, when the gas may be withdrawn from the valve as required. The cylinder is tested up to a pressure of 3,500 lb. per square inch.—E. S.

Chlorine and Alkali Metal Amalgams by Electrolytic Decomposition of Solutions of Alkaline Chlorides, Impts. in Cells applicable for the Production of. [Mercury Cathode.] J. W. Kynaston, Liverpool. Eng. Pat. 15,967, July 21, 1898.

The electrolytic cell contains a number of horizontal, superposed, shallow trays, which are close to, or surround a vertical anode. Each shelf, or each shelf and the bottom of the cell carries a thin and widely extended layer of mercury whereby a very large amount of cathode surface of mercury can be placed around the anode, and the escape of the chlorine from the anode is not impeded as it is from the underside of the anode surface when it is horizontal, and all necessity for moving parts or agitating mechanism is obviated. The mercury is fed slowly through the cathode shelves, so that the amalgam formed, reaches the exit with the requisite maximum concentration.—G. H. R.

Caustic Alkali and Sodium, Impts. in Apparatus for and in the Method of Making. [Mercury Cathode.] J. C. Graham, London. Eng. Pat. 17,415, August 12, 1898.

The apparatus consists of a shallow trough provided with a cover which preferably forms the anode. Through this enclosed vessel the mercury which forms the cathode, and the electrolyte are caused to flow in opposite directions, the circulation of the electrolyte being rapid.—G. H. R.

Alkali, An Improved Electrolytic Apparatus for the Production of. [Mercury Cathode.] W. Thomson, Baron Kelvin of Largs, Glasgow. Eng. Pat. 18,522, August 30, 1898.

The apparatus consists "of a trough divided into two cells," and these cells again into pools through which mercury flows in succession. The first cell contains the salt solution and carbon anodes, and the amalgam formed in it is decomposed in the second cell which contains water and iron, or carbon electrodes metallically connected with the mercury. —G. H. R.

VIII.—GLASS, POTTERY, ENAMELS.

Glass and Allied Products, On the Constitution of. K. Zulkowski. Chem. Ind. **22**, [13], 280—292.

The author points out that, so far as his experiments have been completed, they indicate very clearly the analogy existing between the so-called "glass-producing acids," and he suggests, that all that can be said upon the constitution of the silicate will probably be found to apply also, with certain variations, to the corresponding compounds of boric, titanic, stannic, phosphoric, and arsenic acids, all of which are employed in the glass and ceramic industries. Silicon furnishes three compounds which may be regarded as the starting points of the silicates, *viz.*, orthosilicic acid $Si(OH)_4$, metasilicic acid $SiO(OH)_2$, and silica SiO_2. Orthosilicates are invariably produced when silica is fused at a high temperature with a large excess of alkali. In all other cases, metasilicates are formed. Fusion experiments made with finely ground quartzite and alkali carbonate showed that, even when a large excess of alkali is present, there is a tendency to the formation of metasilicate. In the production of glasses and ceramics, meta compounds can alone be formed, since there is never sufficient base present to form orthosilicates. The maximum amount of silica which can combine with alkali is not known, but must depend, up to a certain point, upon temperature. Alabaster glass, which is a pure potassium silicate, contains 8 molecules of SiO_2 to 1 molecule of K_2O. Water-glass is a tri- or tetra-silicate. When silica is fused with an alkaline earth, or its carbonate, various metasilicates are produced, according to the proportions used. The simplest case is the combination of 1 molecule of silica with 1 molecule of alkaline earth, producing, in the case of lime, a silicate of the formula $SiO.O.O.Ca$. Silicates of lime play an important part in the reduction of iron ores. When dealing with ores rich in sulphur, it is necessary to produce a slag very rich in lime. Under these circumstances, the formation of an orthosilicate would be expected, but according to Rosmann's view, a basic calcium meta-silicate is produced, which can be prevented from changing into ortho compounds by sudden cooling. Thus a hydraulic body is formed, in which half the lime is only loosely combined.

In the production of glass, two bases are required, *viz.*, an alkali and an alkaline earth, or the oxide of a heavy metal, the presence of the second base being necessary in order to overcome the solubility of the glass in water. The proportion of the bases to the silica is usually about that required to form trisilicate. It appears probable from the researches of Mylius and Förster, that such ordinary glass is a true double silicate, and not a mixture of the two silicates.

Pure silicates of the alkalis, if not particularly rich in silica, are more or less soluble in water. According to the views of Mylius and Förster, water-glass in the dry form suffers decomposition on dissolving in hot water, alkali being at first separated, and then dissolving the siliceous remainder. In the author's opinion, however, the decomposition proceeds according to the following equation:—

$$KO.SiO.O.SiO.O.SiO.OK + 2H_2O = SiO(OK)_2 + 2SiO(OH)_2.$$

Alumina, though only of minor importance in glass manufacture, plays a considerable part in the cement and earthenware industries, as well as in the reactions of the blast furnace. The author found it to be more difficult to decompose alkali carbonates with alumina, than with silica, owing to the fusion being incomplete at the temperature employed, as well as probably to the less acid character of alumina. The product, however, was a body of the constitution of diaspor $Al_2O_2(OH)_2$, analogous to metasilicic acid. For the production of higher basic compounds, greater heat would be required. With caustic alkalis, the easily soluble aluminates $Al_2(OK)_6$ or $Al_2(ONa)_6$ are produced. On heating alumina with lime or calcium carbonate, at very high temperatures, products are obtained, corresponding to the metasilicates, which exhibit the analogy between silica and alumina very clearly.

On heating kaolin with excess of alkali carbonate, it was found that the alkali entering into combination, corresponded to that required to saturate the silica. The result explains what has been regarded as a curious fact, *viz.*, that under certain circumstances in slag formation, the alumina appears to figure as a neutral body, which does not combine with the silica. The author explains this by assuming that the alumina produces compounds with the silica which are of an acid character.

In the production of opalescent glass by the addition of cryolite to the glass mixture, complete decomposition is never allowed to take place, or a transparent glass containing alumina would result. In ordinary practice, the decomposition is arrested at an intermediate stage, and the reaction which takes place is probably as follows:—

$$2(Al_2F_6,\ 6NaF) + 5SiO_2 = 2Al_2O_2F_2 + 6Na_2O + 5SiF_4.$$

Such a combination of aluminium and fluorine would seem to be adapted to the formation of an aluminium silicate, and as this would probably possess a different solidifying point to the ordinary glass, opalescence would result.

—H. H. B. S.

PATENTS.

Enamelling Metal Mechanically, An Improved Process for. A. Dormoy, Sougland, France. Eng. Pat. 18,350, Aug. 26, 1898. (Under Internat. Convent.)

The apparatus consists of a closed enamelling cage, with glazed sides or view holes, the upper part of which is furnished with a tightly fitting sliding door for the introduction of the articles to be enamelled, and with an arrangement of hopper, brush, and sieve for distributing the enamel powder. Within the cage is a support for the articles to be enamelled, which can be oscillated or rotated through a considerable angle round a horizontal axis, whilst by means of an internal shaft and mechanism, rotation can be given to the table supporting the goods. When the support is inclined, electromagnets come into action automatically, so as to hold the objects on the inclined table. Every part of the object can thus be covered with the enamel. The surplus enamel collects in a hopper at the bottom of the cage, and can be recovered and used again. A slight diminution of pressure inside the cage insures that none of the fine dust shall escape, and the workman is thus completely protected.

—J. T. D.

Glass Founding, Improved Circular Regenerative Furnace for. W. P. Sauerland, Hamburg. Eng. Pat. 20,616, Sept. 29, 1898.

The hearth of the furnace forms the floor of an annular circular chamber, which is furnished with a corresponding annular vaulted roof; the furnace as described, holds 20 pots. The burner is central, and the burner outlets are arranged radially so that the flames strike over the pots and down their outer sides to the peripheral flues in the hearth (the direction of the current of gas is of course reversible). The regenerators are also radially arranged underneath the hearth. It is claimed that the arrangement gives the maximum heating efficiency, and allows greater working space for the attendants than the ordinary form of furnace. Detailed working drawings are shown.—J. T. D.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Bricks, Colouring with Hydrochloric Acid. M. Gary, Mitth. k. techn. Versuchsanst, Berlin, **17**, [1 and 2], 46—49.

A case was investigated where certain facing bricks, admittedly impregnated with (10—15 per cent.) hydrochloric acid to impart a particular shade of colour, were tested in order to ascertain whether the treatment in question is calculated to produce permanent dampness or efflorescent incrustations. The impregnated bricks exhibited an unsightly brownish exudation which the seller averred could be permanently removed by washing them over with dilute hydrochloric acid.

The results of the tests were as follows:—

1. *Unimpregnated Brick.*—Matters soluble in water, 0·15 per cent. Chief soluble constituents: calcium sulphate and hydroxide. Extract: alkaline and furnishing a crystalline crust of calcium carbonate on concentration. The brick therefore contained free quick lime. No incrustation.

2. *Impregnated Brick.*—Soluble matter: 1·26 per cent. Main constituents: chlorides of calcium, aluminium, and iron; calcium sulphate. Extract: acid with decided chlorine reaction; the powdered brick evolved vapours of hydrochloric acid in drying, hence free acid was present. Efflorescence test: white incrustation of calcium sulphate.

3. *Impregnated Brick* (taken out of wall eight months after building, and carefully freed from mortar).—Soluble matter, 0·43 per cent. Chief constituents: calcium chloride, calcium sulphate, silica. Extract: neutral. Efflorescence test same as 2.

The rust-brown efflorescence on the impregnated bricks consisted of hydrated ferric oxide, ascribed to the reaction of the lime or lime water of the mortar with the ferric chloride formed by the hydrochloric acid with the iron oxide in the bricks.

In consequence of the formation of very hygroscopic chlorides (calcium chloride in particular) in the impregnated bricks a certain amount of moisture is retained, but it is improbable that a sufficient quantity of this moisture to cause damage is communicated to the adjacent brickwork.

The impregnated bricks no longer containing any free acid after being in position for eight months, could not of themselves throw off any further quantity of brown incrustation, but the proposed washing with hydrochloric acid might probably be the cause of subsequent efflorescence, as the result of the partial absorption of the acid itself by the porous brick as well as of the chloride formed by the action of the acid in the removal of the existing brown incrustation.—C. S.

Cements, Constitution of Hydraulic. O. Rebuffat. Gaz. Chim. Ital. **28**, [2]; Thonind. Zeit. **23**, [55], 782—785; [58], 823—826.

For determining the amount of free lime in hydraulic cement the author experimented with: hydraulic lime (in lumps), highly hydraulic lime, and quick- and slow-setting cement (Monferrato); and with hydraulic lime, grey, and white, slow-setting cement (Lafarge du Teil). These materials were prepared by sifting through a sieve with 3,000 meshes per sq. cm. (the lump lime being first slaked), and a portion of each mixed with distilled water, the cakes being left to harden under cover, to prevent access of carbon dioxide. At the end of 24 hours the cakes were immersed in distilled water, left for several months, and eventually dried between paper and by contact with unslaked lime; then powdered, sifted as before, and stored.

The prepared substance was distributed, for testing, in a number of 210 c.c. flasks containing 200 c.c. of a 10 per cent. solution of candied sugar, 1 grm. of anhydrous or hydrated cement being placed in each, and the flasks were shaken up well. From each series, a few flasks were set aside every day for examination, 50 c.c. of clear solution being taken and the amount of dissolved lime estimated by titration with hydrochloric acid, the following average values being found (centigrms. of CaO per 1 grm. of substance employed).

Anhydrous Series.

Days.	Monferrato.				Lafarge.		
	Hydraulic Lime.	Highly Hydraulic Lime.	Portland Cement.	Quick-setting Cement.	Lime.	Grey Cement.	White Cement.
1	23·00	15·40	7·80	8·10	18·70	9·40	12·00
2	23·50	19·70	9·50	10·00	19·50	10·30	13·00
3	25·20	19·40	9·70	10·70	19·90	10·50	..
4	25·00	19·80	10·20	..	20·20	10·50	..
5	25·00	19·80	10·30	..	20·20	..	..
7	24·50	19·55	13·40	10·40	20·20	10·00	13·60
14	..	..	..	..	..	11·10	13·60
28	..	..	..	..	..	11·80	..
35	..	..	14·60	..	..	13·00	..
38	..	..	..	9·40	..	..	..
43	..	..	..	9·40	..	13·10	..
108	..	..	14·60	..	..	..	..
138	24·60	18·00	..	9·40	19·40	13·60	..

Hydrated Series.

Days.	Hydraulic Lime.	Highly Hydraulic Lime.	Portland Cement.	Quick-setting Cement.	Lime.	Grey Cement.	White Cement.
1	26·20	..	12·20	7·30	19·70	14·40	17·60
2	27·00	18·00	16·40	9·20	22·80	15·20	18·00
3	26·40	..	17·00	9·60	23·20	..	..
5	26·00	..	17·00	..	23·10	..	18·90
6	..	..	17·80	..	..	..	..
7	27·00	..	17·20	9·60	23·20	16·00	18·80
14	..	18·10	..	..	22·30	16·00	18·80
21	..	18·00	..	..	22·20	..	18·50
28	..	..	..	..	..	16·00	..
35	..	18·00	17·00	9·60	..	..	18·00
40	..	..	17·00	..	..	..	18·00
52	..	..	17·00	..	..	..	18·20
121	..	..	..	..	22·20	..	18·60
129	..	..	17·00	9·60	..	16·00	..

These figures illustrate the fundamental difference between the anhydrous quick- and slow-setting cements, the former readily parting with their free lime; they also confirm theoretical views on the process of setting and hardening. It is also evident that the slow-setting hydrated cements contain but little free lime, more being, however, gradually liberated under the influence of water.

The relation between the proportion of extracted lime and the chemical composition of the cement is given in the following table:—

	Monferrato.				Lafarge.		
	Hydraulic Lime.	Highly Hydraulic Lime.	Portland Cement.	Quick-setting Lime.	Lime.	Grey Cement.	White Cement.
Chemical composition: SiO_2	14·72	23·00	31·39	24·09	23·27	29·42	25·01
Fe_2O_3	0·83	2·53	3·80	3·02	0·49	1·59	0·73
Al_2O_3	6·44	5·42	7·39	8·42	2·33	3·29	2·75
CaO	60·04	53·50	62·85	55·44	66·71	59·13	62·61
MgO	1·11	1·13	1·37	4·10	0·48	2·27	1·50
Loss on calcination	17·22	12·64	2·96	2·40	7·62	5·09	6·43
After treatment with sugar solution:—							
Anhydrous cement:—							
Loss of lime	24·50	19·50	14·60	9·40	20·20	13·60	13·60
Lime corresponding to Al_2O_3 (for Al_2O_32CaO).	1·12	2·03	2·77	3·15	0·66	1·23	1·03
Residual lime	33·32	31·97	45·48	42·89	45·88	44·30	47·98
Hydrated cement:—							
Loss on calcination	26·68	20·86	20·72	15·38	12·99	14·21	13·78
Loss of water in the setting of 1 grm. of anhydrous material	4·22	9·40	18·31	13·30	5·85	9·60	8·05
Loss of lime	25·40	18·00	17·00	9·60	22·20	16·00	18·60
Loss of lime referred to 1 grm. of anhydrous material	26·32	19·87	20·81	11·09	23·57	17·70	0·22
Lime corresponding to Al_2O_3 per 1 grm. of anhydrous material	2·42	2·03	2·77	3·15	0·66	1·23	1·03
Residual lime referred to 1 grm. of anhydrous materral	31·10	31·60	39·27	41·20	42·51	40·20	41·36
SiO_2 as silicate in lime residue	32·12	42·08	35·26	36·89	35·36	42·25	38·42
SiO_2 as silicate in lime residue, corrected on the basis of (1) CO_2 5·50 per cent.	36·82	36·20	..	36·44	..	39·55	37·10

The loss of lime is smaller in anhydrous than in hydrated cements, the difference being greatest in the slow-setting kinds, and the author concludes that this is due to the presence in the latter of compounds able to react with water but not with sugar solution.

Unslaked Monferrato lime contains 5·50 per cent. of carbon dioxide, the lime combined with which has no hydraulic properties, and must therefore be deducted from that in the silicate residue. The content of calcium silicate in the different samples examined, varies only between 35·26 and 42·25 per cent. The inert, slag-constituents, regarded by the author as the cause of the divergences observed in the silicate residues, were isolated and analysed by dissolving 10 grms. of the anhydrous material in dilute hydrochloric acid, and washing the residue with concentrated hydrochloric acid followed by distilled water, the free silica being separated by hot sodium hydroxide, and the final residue weighed after drying at 100° °C. The same residue being obtained from the hydrated cement proves its inert character. In appearance it is a hard brown to lustrous black powder, partly attacked by concentrated hydrochloric acid and completely fusible in presence of alkali carbonate. The proportion of this constituent in the several materials was as follows: Monferrato highly hydraulic lime, 11·535 per cent.; quick-setting cement, 0·765 per cent.; Lafarge grey cement, 6·610 per cent.; white cement, 2·090 per cent. From the analysis of the product, and its percentage in the materials, result the subjoined apportionments of oxides in the slag-constituents:—

Slag Constituents.	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.
Monferrato:—				
Highly hydraulic lime......	4·52	2·57	0·81	0·13
Quick-setting cement.......	0·44	0·12	0·02	..
Lafarge:—				
Grey cement	2·92	0·85	0·16	0·33
White cement...............	1·37	0·38	0·13	0·14

The values obtained by the author for the grey cement, when examined by the light of Le Chatelier's assumption that these cements result from the admixture of slaked lime, and mono-, bi-, and tricalcium silicates, lead him to conclude that the hydraulic material therein (and in all cements) consists of calcium hydroxide, hydrated calcium aluminate, and hydrated bi-calcium silicate (with 35 per cent. of silica).—C. S.

Coal and Ambrite, New Zealand; Results of the Analysis of Samples of, and of Barbadoes Majak. P. P. Bedson. Trans. North of England Inst. of Mining and Mech. Eng. 1899, **48,** [3], 82.

See under II., *page* 738.

PATENTS.

Wood and other Materials, to Protect the same against Fire and other Destructive Agencies, An Improved Method of Treating. A. J. de Hailes, T. H. Redwood, and H. V. Simpson, all of London. Eng. Pat. 14,897, July 6, 1898.

The treatment consists in impregnating the material with a solution made in either of the following ways:—(*a*), by dissolving oxide of zinc in boric acid "and adding to this solution" sulphate of ammonia; (*b*), by mixing solutions of borax and sulphate of zinc and then dissolving the precipitated zinc borate in solution of sulphate of ammonia; or (*c*), by dissolving oxide of zinc in a solution of acetate of zinc and adding solution of sulphate of ammonia. It is claimed, that the use of zinc or other metallic oxide with the ammonia salt greatly lessens the liability of the impregnated materials to corrode metals when brought into contact with them, by correcting or preventing the development of acidity.—H. H. B. S.

Kilns or Ovens for Firing Bricks and other Ceramic Goods, Impts. in. H. Burridge, Bedford. Eng. Pat. 16,417, July 28, 1898.

A semi-continuous kiln is the subject of this invention; it is formed of a number of chambers communicating by openings in the dividing walls, which openings can be closed by doors worked from the outside. Beneath the floor of the chambers run two parallel flues, which communicate at the end farthest from the chimney-shaft, and unite into one near the shaft. Each chamber opens into each of these flues by holes in the floor, which can be closed by lids; and one of the flues is furnished with a damper beneath each of the partition walls of the chambers. By means of this system of openings, lids, and dampers, the fire-gases can be made to take any course through the chambers, and the fire can be made to heat one chamber whilst the hot air from another, in which the burning is finished, can at the same time be drawn through a third, so as to begin the heating of the objects contained in it.—J. T. D.

Artificial Stone, Impts. in the Process of and Appliances for Producing. W. Olschewsky, Berlin. Eng. Pat. 16,489, July 29, 1898.

The materials used are slaked lime and sand, and either the slaked lime is dried before admixture with the sand, or the mixture of slaked lime and sand is dried before the articles are moulded. The moulded articles are hardened by exposure to steam. In carrying out the process, the moulded articles are conveyed to the steaming chamber on a carriage having an open grating, on which they rest, and below which is a box containing the lime to be slaked for the next batch. During the steaming process, the condensed water drips through the grating from the moulded articles on to the lime contained in the box. Thus, the lime is supplied with water at a high temperature and uniformly distributed, and becomes thoroughly slaked.—H. H. B. S.

Cement and other Substances, Impts. in Kilns for Burning. V. F. L. Smidth, Copenhagen, and E. Rüsager, Port Kunda, Estland, Russia. Eng. Pat. 16,665, July 30, 1898.

The kiln has a lower or calcining chamber, and an upper or preliminary heating chamber, in which the raw material is heated by the waste heat from the calcining chamber.
—H. H. B. S.

Fire Proof, Impts. in rendering Wood, Textile Fabrics, Paper-Pulp, Straw, and the like. L. Litynski, A. Rodakiewiez, and F. Kurowski, all of Lemberg, Galicia, Austria. Eng. Pat. 16,996, Aug. 6, 1898.

The articles are fire-proofed by impregnation with a fluid prepared by mixing together two solutions of the following approximate compositions:—(*a*), water, 500 grms.; carbonate of potash, 130—140 grms.; boric acid, 10 grms.; (*b*), water, 500 grms.; sulphate of magnesia, 40 grms.; carbonate of potash, 25 grms.; sulphate of ammonia, 20 grms.; boric acid, 10 grms. The relative proportions of the various ingredients are, however, varied to suit the materials to be treated.—H. H. B. S.

Drying of Wood and other Materials, Impts. in the, and in Apparatus for Use therein. The British Non-Flammable Wood Co., Ltd., Westminster, and C. Howard, Fulham London. Eng. Pat. 17,980, Aug. 20, 1898.

The apparatus consists of an air-tight drying chamber which can be heated by means of steam pipes, laid in a coil near the floor. The wood is thus heated gradually before the actual drying operation takes place, in order to prevent warping, &c. The drying is effected by means of hot air. By a system of pipes, this is brought into the chamber from a heater, distributed over the wood, passed out into an expansion chamber, and thence into a condenser, where its temperature is lowered, and its moisture given up. After being deprived of its moisture, the air passes again into an expansion chamber, and then into the heater, and so returns to the drying chamber. The circulation of the air through the apparatus is maintained by means of a fan.
—H. H. B. S.

Moulding [Magnesite], An Improved Process and Material for Forming Articles by. J. Steiger, London. Eng. Pat. 18,647, Aug. 31, 1898.

Calcined powdered magnesite is mixed with the requisite quantity of water to form a plastic material suitable for moulding statuettes, &c. The articles moulded with this material are afterwards immersed in carbonic acid gas, which being absorbed, re-converts the calcined magnesite into solid magnesium carbonate.—H. H. B. S.

Cement, Hydraulic; An Impt. in the Manufacture of. J. Steiger, London. Eng. Pat. 18,654, Aug. 31, 1898.

The cement is composed of powdered calcined magnesite mixed with powdered slag, slag wool, scoria, or similar substances. The mixture can be used either direct or after previous calcining.—H. H. B. S.

Woody and other Fibre, Impts. in the Electro-Capillary Treatment of, and Apparatus therefor. A. L. C. Nodon and L. A. Bretonneau, both of Paris. Eng. Pat. 1234, Jan. 18, 1899.

Certain modifications are introduced in the patentees' previous specifications, Eng. Pats. 13,242 and 18,728, both of 1897. The patentees now use a bath containing 10 per cent. of neutral borate of soda and 5 per cent. of resinate of soda, maintained at a temperature of 35° C. A stronger electric current—50 volts—than that before described, is also used. The electro-capillary action causes the solution to penetrate the wood, whilst the sap is carried towards the anode and passes into the bath. The process is complete in five hours, when the bath is skimmed to separate the sap, and the wood taken out and put to dry. The process is said to confer on the wood toughness and impermeability, and also freedom from putrescence, &c. For fireproofing, a bath of alkali phosphate and sulphate of ammonia is used, and for colouring, a bath containing any suitable colouring matter. The apparatus employed is essentially the same as before, being modified only in detail. —H. H. B. S.

Kilns for Burning Cement, Impts. in. P. O. von Krottnaurer, Berlin. Eng. Pat. 5477, March 13, 1899.

The kiln consists of a burning shaft placed immediately over a cooling shaft, the latter being supported upon an iron cone. The cooling shaft is constructed of open ironwork, allowing free access of air. An iron water-pipe, passing vertically through the centre of the kiln, serves the purpose of cooling the clinker, as well as of assisting the draught, by means of the steam which is generated, and passes out at the top. The pipe is connected with a reservoir of water placed at a certain height, so that the water is maintained at a constant level.—H. H. B. S.

Cement, Impts. in or relating to Kilns for the Manufacture of. B. Liban, Podgorze, Bonarka, Krakau, Saxony, Germany. Eng. Pat. 7489, April 10, 1899.

This is a shaft kiln divided into compartments, forming two chambers, the upper for preliminary drying, and the lower for combustion. The division is made by means of two bridges, having openings through which the material can be made to fall. The material is fed into the kiln and falls on to the first bridge, where it is partially dried. It is then passed through the openings and falls on to the second bridge, where it meets with a higher temperature, and is afterwards passed through the openings in this bridge into the combustion chamber. The various parts of the kiln are accessible by means of doors, for feeding in the cement material and the fuel, and for manipulation. The lower portion of the kiln constitutes a cooling chamber. At the bottom is a grate.—H. H. B. S.

Wood and the like, New or Improved Process and Material for Impregnating. J. Schenkel, Dortmund, Germany. Eng. Pat. 9671, May 8, 1899.

The impregnating fluid is a solution of basic calcium chloride, prepared by dissolving caustic lime in a solution of ordinary calcium chloride. The impregnation is carried out by a soaking, as opposed to a boiling, process, and the solution should be used whilst it is fresh.—H. H. B. S.

Asphaltic Fluxes, Impts. in, and in the Manufacture of. W. Lloyd Wise, London. From G. F. Culmer and George C. K. Culmer, Chicago, U.S.A. Eng. Pat. 11,687, June 5, 1899.

In the preparation of asphaltic cements employed, for example, in paving or roofing, it is usual to admix about 80 per cent. of refined Trinidad asphalt with 20 per cent. of the oil residuum from petroleum distillation. Such mixtures are liable to become soft under the action of the summer sun. If, however, the residuum is first submitted to a prolonged heating (380° F.) and at the same time to the oxidising action of air, a flux may be obtained which, mixed even in larger proportions than above stated with asphalt, renders the cement at once firm and elastic in winter without being brittle, and yet not liable to become soft on exposure to the heat of the sun.—S. K.

X.—METALLURGY.

Iron Ore in Kent. E. Riley. Daily Chronicle, Aug. 9, 1899.

See under Trade Rep, *page* 800.

Nickel from its Ores by the Mond Process, Extraction of. W. C. Roberts-Austen. Proc. Inst. of Civil Engineers, **135**, Nov. 8, 1898.

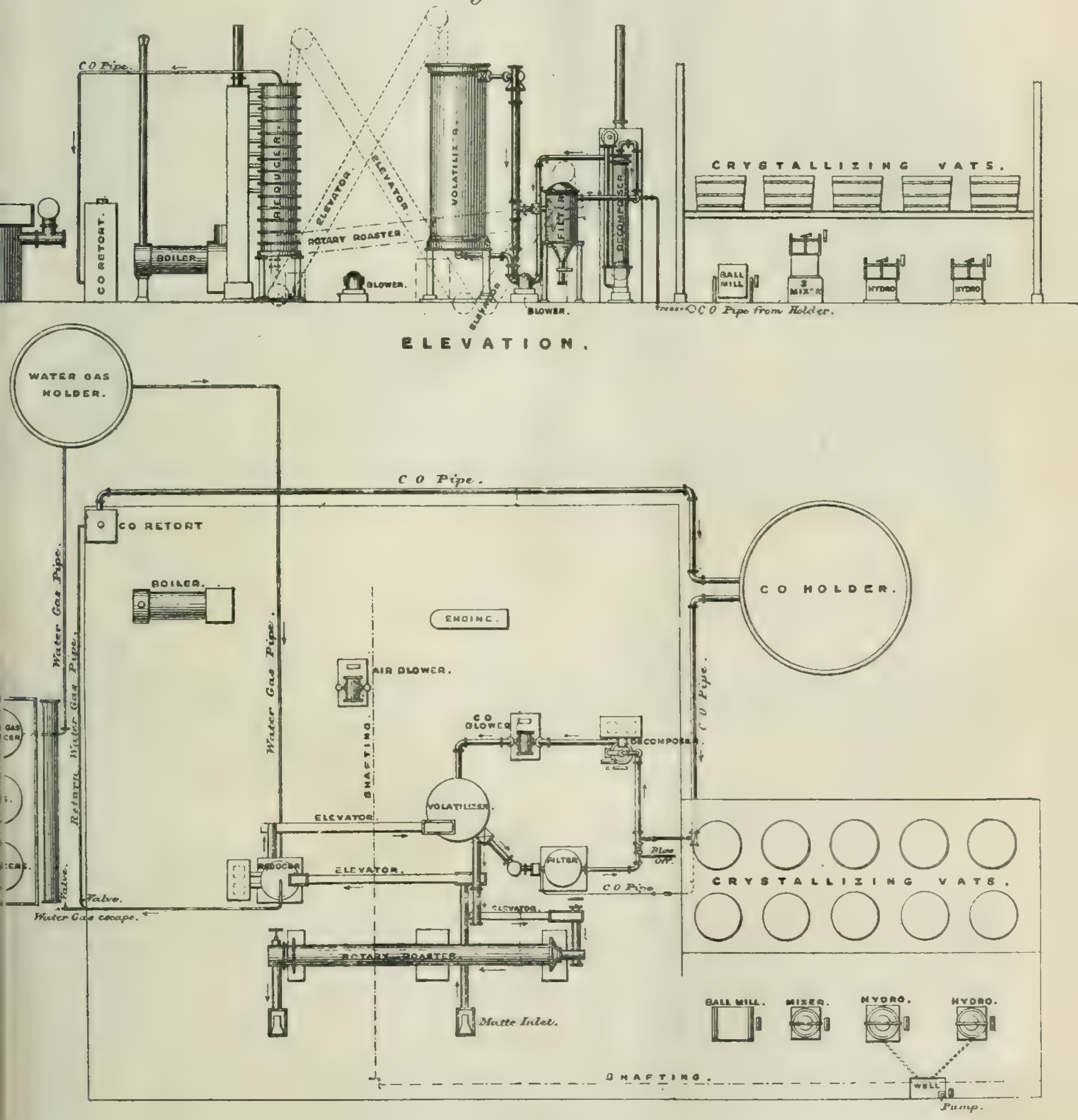
This paper contains a full description of the above process, which is the first, and at present the only, metallurgical process wherein a metal is extracted and purified by combining it with a gaseous body, which carries it off as a gaseous compound, and separates it from the other metals and residues (this Journal, 1890, 808; also 1895, 945—946). Although the melting point of nickel is about 1,600° C., and its metallurgical purification and separation from cobalt are attended with some difficulty, the nickel is now completely separated from the cobalt, &c., by warming the finely-divided metal in a current of carbon monoxide to between 50° and 100° C. to form nickel carbonyl, which passes off to be elsewhere heated to from 180° to 200° C., to decompose it into metallic nickel and carbon monoxide again. Iron is the only other metal which is found to produce a similar volatile compound with CO (this Journal, 1891, 644; also 1892, 750), but its production is avoided in the operation by keeping the temperature as low as possible. This iron compound is a liquid containing five equivalents of CO to one of Fe, and distils without decomposition at 102°·8 C. The nickel carbonyl is also a liquid at low temperatures, with sp. gr. 1·3185 at 17° C., and distils without decomposition at 43° C. It is soluble in alcohol, petroleum, and chloroform, and is not acted on by dilute acids or alkalis. It contains four equivalents of CO to one of Ni.

In its metallurgical application (this Journal, 1891, 774; also 836—837), the nickel ores are calcined to remove arsenic, sulphur, &c., and reduced to the metallic state by heating the resulting oxide with reducing gases. When the nickel is in combination with silicic acid, &c., the ore is treated to produce a speise or a matte, which is then calcined, or Bessemerised and roasted. In the early experiments, the nickel was deposited from the carbonyl in layers upon thin steel sheets lining a series of retorts, but the metal was found to be difficult to cut. It is now deposited on small granules of commercial nickel kept in motion to prevent cohesion, the granules being screened to separate the smaller ones, which are returned for further deposition (this Journal, 1899, 49). It is found during this operation that small particles of the deposited metal become detached, each one forming a nucleus for further deposition, so that beyond the starting point, the employment of commercial nickel granules is hardly necessary.

An experimental plant was erected at Smethwick in 1892, and after many reconstructions has assumed the general form described and illustrated in this paper. Figs. 1 show an elevation and plan of the plant. The present author recently visited these works and now describes in detail the process as being conducted at that time. The material under treatment was a calcined Bessemer matte from Canadian ore and contained 35·4 per cent. of nickel, 41·8 per cent. of copper, and about 2 per cent. of iron. This, after grinding and passing a 60-mesh screen, was treated in lots of 3 cwt. with 200 lb. of sulphuric acid diluted with 20 cub. ft. of mother liquor from previous operations, and kept at a temperature of 85° C. for half an hour. By this means some of the oxide of copper was dissolved and the solution separated from the nickel oxide by a hydro-extractor and afterwards crystallised for the copper sulphate, which contains only 0·05 per cent. of Ni, and 0·048 per cent. of Fe. The small quantities of nickel and iron oxides, which dissolve with the copper oxide, gradually accumulate in the mother liquor, which from time to time is partially exchanged by water, the metallic oxides being extracted by evaporation and roasting. The residue from the acid now contains 52·5 per cent. of Ni, 20·6 per cent. of Cu, and 2·6 per cent. of Fe, and is fed into the matte inlet [Fig. 1, plan], whence it is transported by a spiral conveyor to the elevator and thence to the reducer. Herein the oxide is reduced to finely divided metal by falling over a series of hollow shelves, heated to a temperature of 250° C. by producer gas, in a vertical tower in the presence of water gas. There are 14 shelves, the lowest five of which, however, are not heated but are cooled by water to reduce the temperature of the metal previous to its withdrawal and elevation to the top of a somewhat similar tower, called the volatiliser, wherein the carbonyl is formed, the shelves in this case not being hollow and heated, since the heat required, 50° C., is supplied by the gas and reduced material itself (this Journal, 1897, 47). After losing some of its nickel the solid material is passed back to the reducer to present a freshly reduced surface and then to the volatiliser again and so on, backwards and forwards.

The gaseous carbonyl is then passed through a filter, to remove any matte-dust, into the decomposer which is shown in two vertical sections at right angles in Fig. 2. The CO from this is, by means of a blower, passed again into, and through, the volatiliser. The decomposer consists of a cylindrical vessel, A, preferably built up of short cylinders, *a a*, bolted together, containing a central vertical tube, C, provided with gas outlet holes, O, through which the carbonyl passes from the inlet, B, into the mass of granules of nickel contained in the vessel, A. After being deprived of the nickel, the gas is passed out through the outlets, L, into the gas exit pipe, M. To prevent the granules from cohering they are kept in motion, by slowly and continuously withdrawing them from the bottom of A, by means of a right and left-handed worm conveyor, U, and passed into two sifting drums, N. The smaller granules fall through on to the inclined plane, W, and collect at the base of the elevator, E, which carries them up to, and drops them through, the feeding hole, X, into the vessel, A, for further deposition. The larger particles are carried into side passages, down which they fall into the closed funnel-shaped chamber underneath, whence they are released by means of the valve at its base. A rod, R, fixed to the spindle of an external handle, is provided as a feeler for the level of the granules in A. In order to avoid the deposition of nickel in the

Fig. 1.



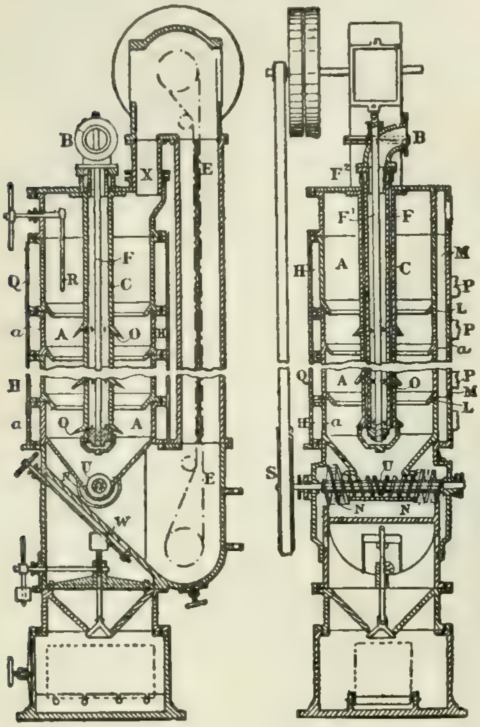
ELEVATION.

PLAN.

SCALE 1 INCH = 30 FEET.

central tube, C, it is kept cool by the circulation of water opwn the tube, F, and up through passages, F¹, formed in the central tube, to the water outlet, F².

Fig. 2.



The cylindrical vessel is surrounded by a wrought-iron casing, Q, which forms heating spaces, H, communicating with heating flues, P, which are so arranged that the temperature of each cylinder can be separately regulated by dampers to maintain the whole of the nickel granules at about the uniform temperature of 200° C. Magnified sections of the granules show distinctly the concentric deposits of nickel, some with a kernel of commercial nickel and some without, the latter being originally started by the small detached pieces previously mentioned.

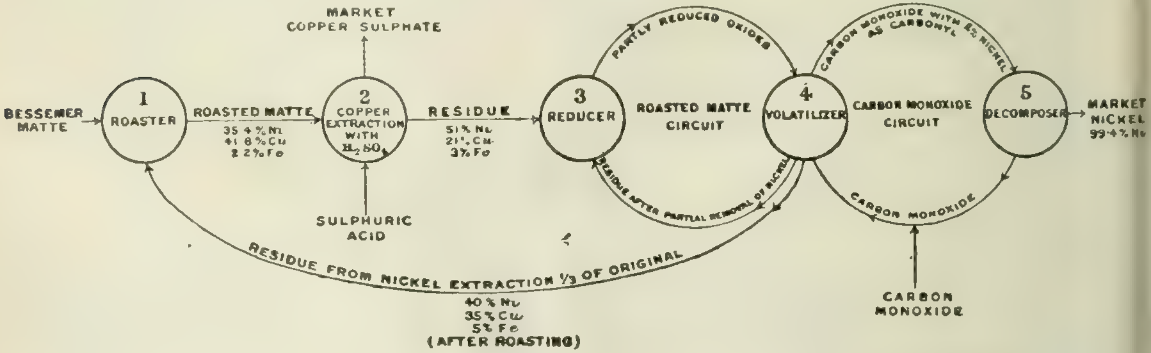
The water-gas is generated in gas-producers by anthracite and steam, and supplied through a gasholder. Before reducing the oxide it contains about 60 per cent. of hydrogen, but afterwards not more than about 5 to 10 per cent. Part of this used gas is cooled by water spray to condense its aqueous vapour, and is then passed through incandescent coke, to reduce any CO_2 to CO, and conveyed to a separate gasholder to be stored for use in the volatiliser.

When the material in the volatiliser has been deprived of the bulk of its nickel by repeated treatment in the reducer and volatiliser alternately for from 7 to 15 days, it is passed out of the latter to an elevator, which raises it to the higher end of an inclined rotary roaster, wherein it is oxidised. The ratio of nickel and copper is still about the same as in the original matte, but the extraction of these metals has increased the proportion of iron. The oxidised material is again treated with sulphuric acid to remove copper oxide, and the residue once more subjected to the reducer and volatiliser operations. The extraction of nickel in the first treatment amounts to about 61 per cent., which is augmented by this second treatment to 80 per cent. of the total quantity present in the matte. The exhausted charge is withdrawn and passed back for re-smelting with fresh matte. Two analyses of the deposited nickel show the following composition:—

——	I.	II.
	Per Cent.	Per Cent.
Nickel	99·82	99·43
Iron and (Al_2O_3)	0·10	0·43
Sulphur	0·0068	0·0099
Carbon	0·07	0·087
Insoluble residue	..	0·026

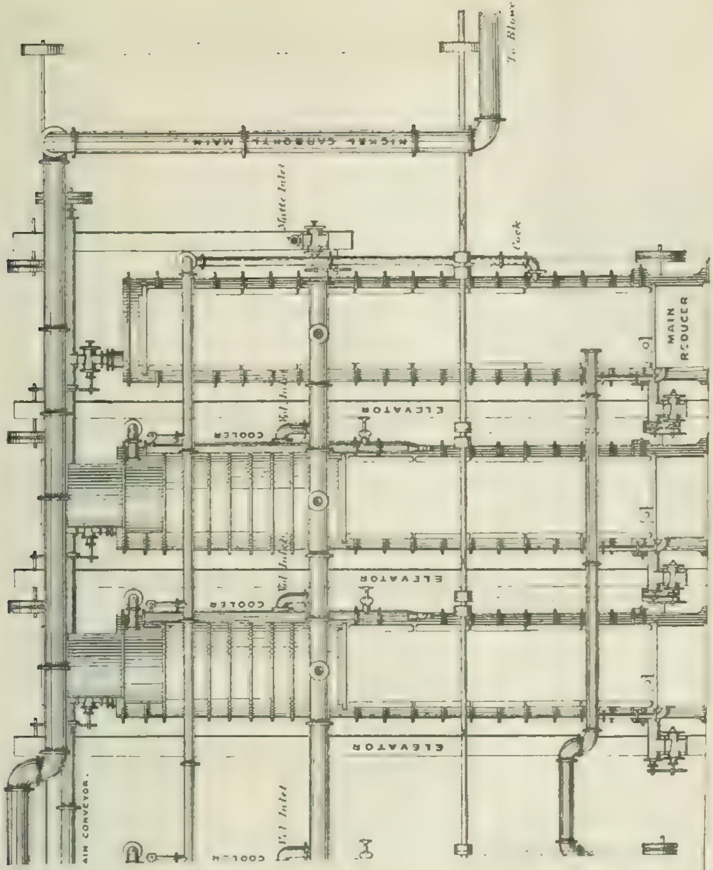
The author gives a diagramatic sketch of the various operations in Fig. 3, which shows the two separate complete circuits, of the CO (4 and 5) and of the partially reduced oxides (3 and 4) which repeatedly meet and pass each other in the volatiliser (4).

Fig. 3



The plans of a large manufacturing plant capable of producing 1,000 tons of nickel per year are shown in sectional elevation, sectional plan, and vertical cross section of plan in the accompanying drawings, Figs. 4. They consist of 10 vertical cylindrical vessels in series; the first is the main reducer, in which the roasted matte is first reduced; the next eight are combination volatilisers and reducers, the upper portions acting the part of the former, and the lower portion the part of the latter; and the last, or tenth, vessel is the main volatiliser. The reduced material from the first vessel is raised by an elevator into a main conveyor connected by rotary valves with the tops of all the vessels, by which it can be conveyed to any or all of the volatilisers. In regular working, however, it is taken to the second vessel, down which it falls, first through the upper volatiliser portion, where it meets with an upward current of CO, and thence through the lower reducer portion, where it is further reduced by an upward current of water-gas or producer-gas. The material is then carried up by another elevator and conveyed to the third vessel for similar treatment, and then again to fourth, fifth, and so on, until the tenth, which from top to bottom is constructed as a volatiliser only. This series of operations constitutes the first treatment which extracts the bulk of the nickel. The

Fig. 4.



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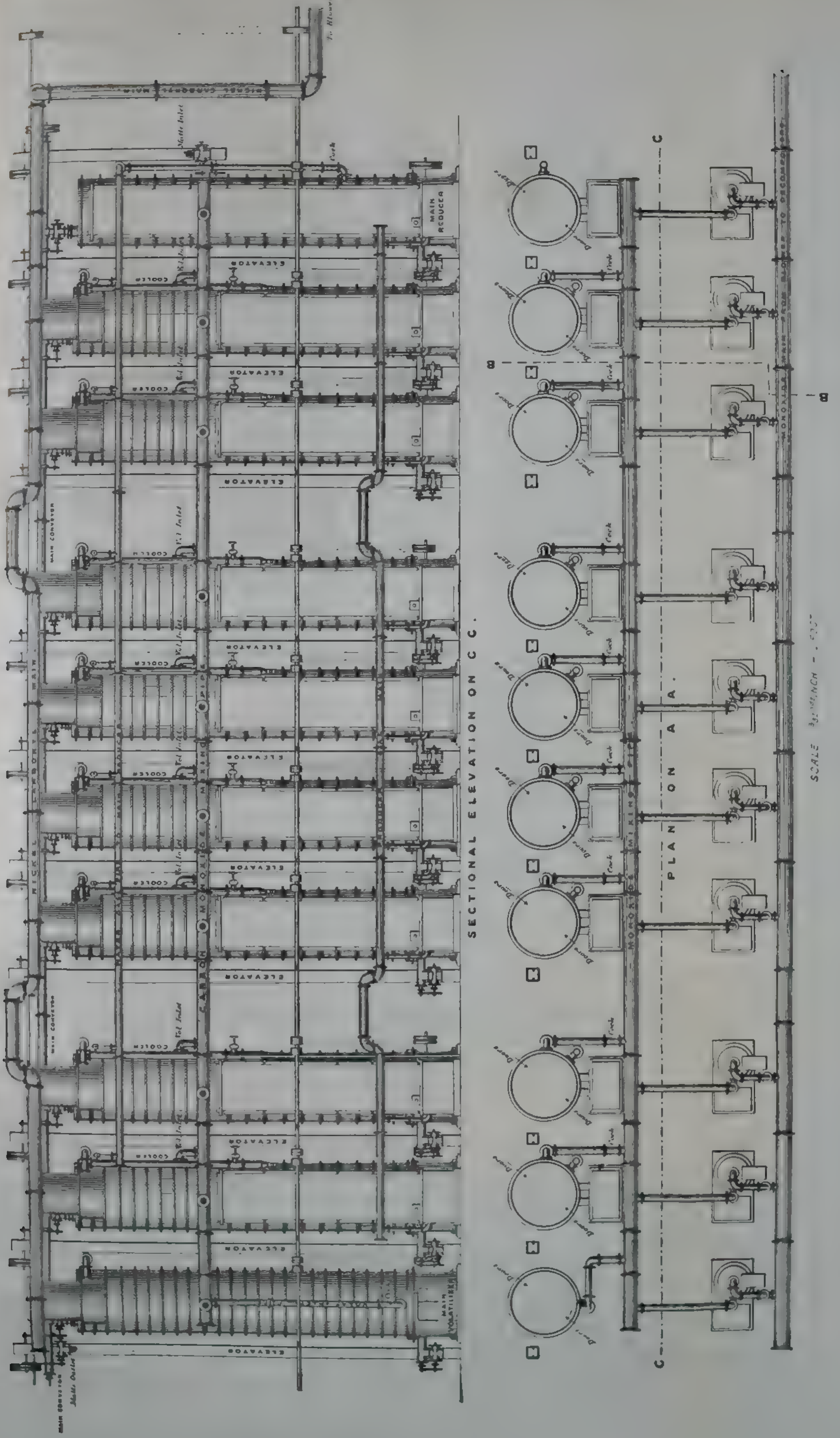
the ovens. This method also has the advantage of securing a regular supply of coke, and avoiding breakage of the latter in handling and transportation. It is estimated that

adjusted, reheated to a temperature just above its point of transformation, so as to attain the maximum of magnetic intensity, and after cooling is heated to 100° C. It is then allowed to cool and is magnetised.—J. T. D.



SECTIONAL ELEVATION ON C C.

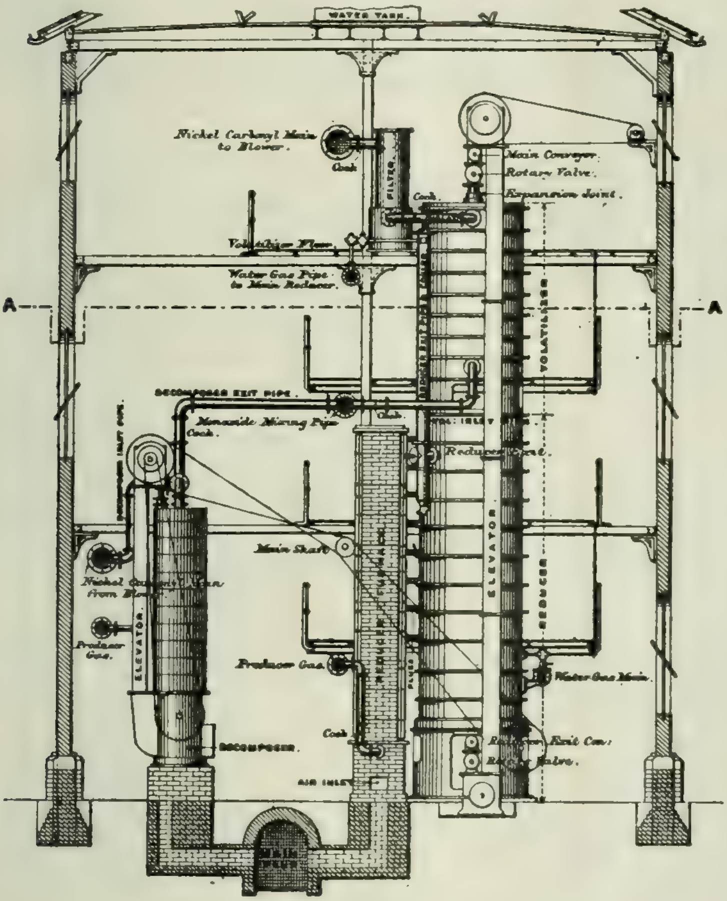
PLAN ON A A.

SCALE 3/32 INCH = 1 FOOT

solid material from the last vessel is now discharged into the roasting furnace, where it is prepared for extraction of copper by sulphuric acid previous to the second reducer and volatiliser treatment.

Owing to the low temperature throughout the process, the repairs to plant are very slight, and the item for fuel is small. The process is automatic, and the labour cost need not be great. The main operation is regenerative, and the only new material continuously required is water-gas for the reducers, and part of this, after the reduction, is reconverted into CO and used for the volatilisation of the nickel.—A. W.

Fig. 5.



CROSS SECTION ON B B.

SCALE. 9/32nds INCH = 1 FOOT.

Blast-Furnace Gases, Power from. E. Disdier. Iron and Steel Inst. May Meeting, 1899.

The most important objections to the use of blast-furnace gases are the large quantities of dust carried by them and their variable composition. The author suggests an installation of coke ovens in the neighbourhood of the furnaces, of sufficient size to supply the fuel needed for the plant. The gas from the coke ovens can then be used in the gas engine, whilst the blast-furnace gases can be utilised to furnish the heat required in coking. The variable composition of the blast-furnace gases would be no objection, as it would be counteracted and regulated by the heat which is stored in the ovens. This method also has the advantage of securing a regular supply of coke, and avoiding breakage of the latter in handling and transportation. It is estimated that working in this way, with a furnace making 100 tons of pig iron daily, the gas engines could readily be of 3,500 horse-power, or fully 2,400 horse-power more than could be obtained by using the gas under boilers to raise steam. The difficulty due to the presence of dust in the blast-furnace gases is also avoided, to a great extent, by this method, it being only necessary to prevent the dust from collecting and choking the passages through which the gases are conveyed.

In the discussion on the above paper several members considered that Disdier had greatly over-estimated the difficulties due to variable composition of the waste gases. In practice regularity of working in the engines had been secured after a few trials only.

Purification of blast-furnace gases from the dust carried over by them may be carried out very satisfactorily by an arrangement of passages, in which abrupt changes of direction, and collecting chambers, serve to throw down the heavier part of the dust.—A. S.

Alloys, Expansion of, by Heat. H. Le Chatelier. Comptes Rend. **128**, [24], 1444—1447.

Formerly the author found that the maxima in curves of fusibility of alloys did not always correspond exactly to a composition of the fused portion of such alloys, which is identical with that composition of the definite compound to which these curves are imputed. This probably arises from the fact that a solid solution of the compound in excess of one or other metal is obtained. To ascertain whether this was so he has determined the coefficients of expansion of alloys of varying composition; the publication of Stead's results (this Journal, 1898, 1111) has led him now to publish his observations on the alloys of copper with antimony and with aluminium. In both these cases, the alloys showing maximum fusing point exhibit also a maximum coefficient of expansion, greater than that of pure copper or of the definite compound near in composition to the alloy. They are then solid solutions; for had they been constituted simply by juxtaposition of crystals of copper and of the compound nearest in composition to the alloy, they should have had coefficients of expansion intermediate between those of their constituents. These correspondences occur in a striking manner in alloys differing by 3 or 4 per cent. in their copper content from the compounds $SbCu_2$ and Al_2Cu. For the same copper-antimony alloy, Kamensky has found a maximum electric resistance, whilst Stead finds it to be homogeneous in texture.—J. T. D.

Steels, Magnet. F. Osmond. Comptes Rend. **128**, [25], 1513—1516.

The author has sought to ascertain the best method of treating manganese-, nickel-, and other "self-hardening" steels, so as to secure the highest degree of magnetic power. After forging a compass needle, for example, it is heated to a temperature just below its point of transformation, adjusted, reheated to a temperature just above its point of transformation, so as to attain the maximum of magnetic intensity, and after cooling is heated to 100° C. It is then allowed to cool and is magnetised.—J. T. D.

Steels, Nickel, Temporary and Residual Variations of Reversible. C. E. Guillaume. Comptes Rend. **129**, [3], 155—158.

Bars of nickel steel with anomalous negative dilatation (this Journal, 1897, 614; 1898, 355) on cooling or heating to a definite temperature, slowly expand or contract after that temperature is reached, and attain a stationary condition only after weeks or months. The author has determined the amount of this residual change in several cases, and gives a correction for it, which should be applied in correcting standard measures of length, &c., for change of temperature, inasmuch as the usual coefficients are based upon observations with rapid temperature changes.

Drawn bars differ from forged bars in that, on being heated to 100° C., after being long kept at the ordinary temperature, they shorten for about half an hour, then lengthen for several hours, and finally shorten again for four or five days. This third change has been observed in bars of pure nickel and in nickel steels which do not undergo the first two changes. It does not occur if the bar has been previously annealed at a higher temperature, while the other changes, characteristic of nickel steels of low expansibility, are not affected by such annealing.—J. T. D.

Ores [Chlorination of], The Jackson System of Treating. A. Phillips. Eng. and Mining J. 1899, **68**, [2], 34.

It is claimed that this system is simple, practical, effective, and economical, and that it saves a very high percentage of the values.

The suitably crushed and pulverised ore is calcined until "sweet," *i.e.*, until it contains not more than 0·5 per cent. of sulphur. A dead roast is to be preferred; and any good automatic calcining furnace can be used, although Jackson has recently invented an automatic, reverberatory, calcining furnace, specially adapted for use in this process. After completion of the roast, and whilst the ore is at a high temperature (say, 1,500°—2,000° F.), a chlorinating flux of two parts of sodium chloride and one part of iron sulphide is fed into a chamber beneath the furnace, over which the fire passes, "thereby extracting all free air from the chamber and retaining the heat sufficiently to generate chlorine gas in the ore, converting the gold, silver, and copper into chloride." The chlorinating chamber is sufficiently large to hold the entire output of the roasting furnace for 12 or 24 hours, and the discharge of the calcined ore into the chamber is continuous. About 12 hours is the time required to complete the chlorination. An automatic cooling conveyor passes the chlorinated ore from the chamber to the leaching tanks, the heat being dispelled in transit. If the ore contain copper, the chlorides of that metal are washed out with cold water, and the copper recovered by means of scrap iron. The gold and silver chlorides are dissolved out with a strong solution of sodium thiosulphate and sodium chloride (five parts of the former to one of the latter). The solution is passed through troughs about 150 ft. long by 1 ft. wide, in the bottom of which is a line of zinc plates. The latter are about 2 in. apart, and one pole of an electric battery is connected with the first plate of the line, and the other with the last. The current passes from plate to plate through the solution, and the gold and silver are deposited on the plates. The precipitated metals are brushed down into settling tanks, collected, washed, dried, and melted into bars. The exhausted solution passes into a sump tank, and is then pumped back into the mixing tank, re-standardised, and used over again.

It is stated that dry, refractory ores belonging to the sulphide, telluride, and kindred groups can be treated under normal conditions as to location, cost of fuel, labour, and supplies, at an average cost of $3 per ton, with an extraction averaging above 90 per cent. of the gold and silver values, that is, provided modern machinery and appliances be used, and that all mills be completely automatic. —A. S.

Gold Field, The Lucknow (N. S. Wales). A. R. Canning. Trans. Inst. Mining and Met. 1899, 24 pp.

The Lucknow gold field, situated 200 miles from Sydney in New South Wales, has produced not less than 15, and probably many more, tons of gold, although it is only about half a mile square. The gold occurs free and as auriferous arsenical pyrites and gold-bearing antimony; these minerals are accompanied by pyrrhotite, iron pyrites, zinc blende, and, more rarely, by galena, common pyrites, stibnite, kermesite, and cobalt bloom. The gold is frequently found in calcite in threads, plates, and small dendritic masses; and often large pieces of calcite several pounds in weight are obtained yielding 40 per cent. bullion, but with few fragments of gold weighing more than 1 dwt. The mispickel free from visible gold commonly yields 100 to 800 ozs. per ton, but where gold can be seen in it, it may run to 1,500 to 3,000 oz. per ton. The antimony contains from 1 to 10 dwt. of gold per unit of Sb.—W. G. M.

Gold, Contributions to the Examination of. W. Witter. Chem. Zeit. 1899, **23**, [49], 522.

The author has made a number of experiments to test Bock's method (see this Journal, 1898, 695), and to answer the following questions:—(1.) What is the difference as to accuracy, in the technical gold assay, and the analytical method? (2.) Is the cupellation method exact enough to justify purchase of large quantities of gold on such a basis? (3.) Is an analysis of practical use with regard to the loss of interest on a large stock of gold? (4.) What advantages does Bock's method offer? and (5.) How far may it be trusted? Four different sorts of gold were used in this work. (1.) Gold, electrolytically refined, the so-called ribbon gold (see this Journal, 1898, 585.) (2.) Unmelted electrolytic gold taken direct from the cell. (3.) Washed gold, average sample from several kilos. of crude gold, as sent out at present from Hong Kong. (4.) Mint gold. 100 grms. each of these four varieties of gold were analysed according to Krüss' method (Annalen, 1887, **238**, 43), for the estimation of the metals of the platinum group the method of Stas and Deville (Ber. 1892, **25**, 665) was used.

	I. Ribbon Gold.	II. Electrolytic Gold.	III. Washed or Crude Gold.	IV. Mint Gold.
Os + Ir	..	..	0·0340	..
Pt	0·0030	0·0060	0·0144	0·0450
Pd	Trace	..	..	..
Cu	0·0190	0·0045	0·4360	9·1762
Pb	0·0006	..	0·0112	0·0038
Ag	Trace	Distinct reaction.	2·1214	0·8023
Bi	..	..	0·0018	0·0011
Fe	0·0060	Not estimable.	0·0182	0·0205
Zn	Distinct reaction.	..	0·0320	..
Ni and Co	..	..	..	Trace
Au (by difference).	99·9714	99·9892	97·3310	89·9511

In the process of cupellation the temperature is of great importance. Rose (Metallurgy of Gold, 1896, 441) using Le Chatelier's pyrometer, found a loss of 0·01 per cent. of gold for every 5° C. increase of temperature. The author employed Heraeus' platinum-rhodium element, and the galvanometer of Keiser and Schmidt, and was thus able, by maintaining a constant temperature, to obtain results agreeing with analysis. A number of cupellations were performed with the four varieties of gold at different temperatures. For chemically pure gold, the temperature should be 960° C., for less pure gold 950°—960° C., and for gold containing very small quantities of Pt. 1,000°—1,010° C. Ductile gold of $\frac{973}{1,000}$ containing silver and copper requires about the same heat as pure gold, gold with 900 Au, and 100 Cu, 920°—930° C., and $\frac{720}{1,000}$ gold (with silver and copper) less than 900° C. If a good pyrometer is not at hand, alloys may be used, melting between 850°—1,050° C., which might be obtained from the Frankfurter Scheideanstalt, and by these means the result of the cupellation process will not differ more than 0·02 per cent. from the actual amount of gold.

As to questions 2 and 3, the error of 0·02 per cent. under or above the real gold value is not very great.

Should the sellers' and buyers' results really differ by 0·04 per cent. the average might be taken or a third assayer might decide. In any case, for 1,000 kilos. of gold, representing a value of 137,500*l.*, 0·02 per cent. would only come to 200 grms. or 27*l.* 10*s.* This is a small sum compared with the daily interest of 19*l.* (at 5 per cent.), and the cupellation process should be from this point of view, sufficient under ordinary circumstances.

The author has further tested Bock's method, which gave a plus averaging from 0 to 0·02 per cent. Although the old way, as proved by the author's work, is exact enough, Bock's process, in many cases, has great advantages. It requires less skill and does not depend on the temperature. On the other hand, as Bock himself admits, it is applicable only to a limited number of cases (Mint gold).—S. K.

Gold, Researches on Quantitative Estimation and Separation of, from Platinum and Iridium. L. Vanino and L. Leemann. Ber. 1899, **32**, [11], 1968.

See under XXIII., *page* 788.

Nickel and Cobalt, The Thermal Expansion of Pure. A. E. Tutton. Proc. Roy. Soc. 1899, **65**, [415], 161.

See under XXIV., *page* 791.

Iron, Action of Liquid Sulphurous Acid on. A. Lange. Woch. für Brau. 1899, **16**, [27], 357.

See under VII., *page* 759.

Carbon Monoxide, Decomposition of, in Presence of Metallic Oxides. O. Boudouard. Comptes Rend. **128**, [25], 1522.

See under II., *page* 742.

PATENTS.

Ores, Metallic [Sulphides, Chloride of Sulphur Treatment], Impts. in Apparatus for Use in the Treatment of. F. A. Edwardes, London. Eng. Pat. 11,011, May 14, 1898.

The containing vessel is formed by the annular space between two concentric walls, and is provided with a perforated false bottom placed upon a filtering material. Up the central space passes a revolving shaft with radiating bars carrying stirring arms with stirring boards at their lower ends, which travel round the annular space over the false bottom. Towards the upper end of the arms are placed skimmers or baskets of woven cane or hair which dip partly under the bath, and in revolving remove particles of sulphur, &c. floating on the surface. The top is enclosed with a cover, with suitable cocks for drawing off the noxious gases formed, and a filling tube is fitted in one side of the vessel. The whole vessel can be tilted to remove the sludge through a doorway on the other side situated on a level with the false bottom, after the solution has been withdrawn through the filtering material.—A. W.

Ores or Mattes [Cu, Au, &c.], Impts. in the Treatment of Sulphide, Complex or other, and the Recovery of Metals therefrom. J. Armstrong, London. Eng. Pat. 11,895, May 25, 1898.

The complex ore or matte is mixed, after roasting if necessary, with about one-third of its weight of carbonate of soda, or potash, and with carbon to about one-ninth of the weight of the soda, and the whole is finely ground together, and fused for the reduction and extraction of the metals.

If gold or silver be present, a lead ore is also mixed in and the charge heated to an orange-red to reduce the lead which, carrying the gold, is then tapped off. The remainder of the charge is then heated to a higher temperature to reduce the other metals as before.

If gold and silver be present with antimony, the latter is distilled off, leaving the former in the residue for further treatment.—A. W.

Gold and Silver Extraction, Impts. in. J. J. Hood, London. Eng. Pat. 16,399, July 27, 1898.

A galvanic couple precipitant is described and claimed for precious metals. It consists of 100 parts of zinc, to which, when molten, 5 parts of antimony have been added, and to the alloy produced, when partly cooled, 20 parts of mercury, which have been heated nearly to boiling, are mixed in. Bismuth, arsenic, or phosphorus may be employed in place of the antimony. The slabs of the alloy are granulated or broken, and the gold and silver solution brought into contact therewith.

In cases where mercury is also in solution, as when the author's mercury solvent has been used (this Journal, 1895, 808), the mercury is also precipitated, and the precipitant is removed from time to time, and the excess distilled off to enable the remainder to act.—A. W.

Flue Dust [Zinc, Lead, &c.], obtained from Sulphide Ores. An Improved Method of Treating. R. Threlfall, Preston. Eng. Pat. 11,940, May 26, 1898.

The flue dust and fume from the smelting of sulphide ores of lead and zinc are treated with a solution of potassium or sodium hydrogen sulphate, such as nitre-cake, by which the zinc is dissolved and separated from the lead, the metal being afterwards recovered by any suitable process.—A. W.

Ores [Lead], Impts. in the Treatment of, for obtaining Metals and other Products therefrom. S. O. Cowper-Coles, London. Eng. Pat. 14,137, June 25, 1898.

In conjunction with a previous patent (this Journal, 1898, 1053) for roasting galena with blende, extracting the zinc and copper, and treating the residue with caustic soda to produce sodium plumbate, the sulphur dioxide from the roasting is now passed into water containing chalk whereby a mixture of the sulphur dioxide and carbon dioxide is obtained. This is passed through the sodium plumbate solution and a lead sulphite, for paint, is precipitated. The remaining carbon dioxide is passed through a fresh solution of sodium plumbate, heated to 80° C., to produce white lead. The bulk of the plumbate, however, is electrolysed, or it may be evaporated and heated to about 70° C. to yield litharge. —A. W.

Zinc and other Ores, Improved Furnace for Treating Sulphides containing. H. R. Angel, London. Eng. Pat. 14,523, July 1, 1898.

The furnace is a long flat one, with a false bed which slopes longitudinally from both ends towards the centre. The bed is made up of two layers of tiles, one upon the other, which rest on longitudinal rows of bricks on the lower bed. The flames from an outside fire-grate pass along the channels between these rows of bricks from one end to the other, underneath the false bed upon which the charge is placed. They are then directed through a suitable opening at the end, into the furnace chamber and, together with the products from another fire-grate, are passed over the charge, the roof inclining towards the stack, so that the combustion products are kept out of contact with the same. By this means, in the treatment of zinc sulphide and other ores, the sulphide of sodium on the furnace bed is protected against conversion into sulphate, which would prevent the subsequent production of caustic soda.—A. W.

Sulphide Ores [Zinc, Lead], Impts. in the Treatment of Refractory. F. Ellershausen, London. Eng. Pat. 15,645, July 16, 1898.

In the smelting of refractory sulphide ores, containing zinc and lead, in a cupola or blast furnace with the ordinary blast, the author uses an additional exhaust sufficiently powerful to prevent any zinc accretions forming in the furnace.—A. W.

Zinc and Lead, Impts. in or appertaining to the Smelting of Complex Sulphide Ores containing. J. Armstrong, London. Eng. Pat. 16,312, July 26, 1898.

This is the sequel to a previous patent (this Journal, 1897, 1020) for heating sulphide ores, containing zinc and lead, with an alkali salt and a little lime, to flux off the silica and carbon, and the present improvements consist of: (*a*) the dispensing with the use of lime by a preliminary removal of the siliceous gangue from the ore; (*b*) the addition of lead when the ores are poor in this metal; (*c*) the preliminary and very fine grinding of the materials; (*d*) the treatment of the slag by disintegrating it with steam or other means, leaching out the soluble matter with water, calcining the residue if desirable, mixing it with carbon and distilling off the zinc; and (*e*) the application of nascent alkali metal for the smelting of complex sulphide ores containing zinc, when the nascent alkali metal is produced by other means.—A. W.

Zinc, Impts. in the Extraction of, from its Ores. J. Armstrong, London. Eng. Pat. 16,388, July 27, 1898.

The process of roasting, mixing with an alkali salt, with or without fluxing material, lixiviating the soluble matter, and distilling with carbon, is claimed for application to the smelting of any ore of zinc, and also mattes or slags. (See foregoing abstracts, Eng. Pats. 11,895, and 16,312.) In addition, the employment of lead in some convenient form, if precious metals be present, and its preliminary reduction to metal at a low temperature to remove the same, previous to the extraction of the zinc as before mentioned.—A. W.

Slag Wool or Silicate Cotton, Impts. in the Manufacture of. W. S. Hill and W. P. Ingham, Coatham, Redcar, Yorkshire. Eng. Pat. 17,466, Aug. 13, 1898.

From 1 to 2 per cent. of soda ash is added to molten slag, either as it is taken direct from the furnace in a ladle, or, if it is remelted, in a cupola. The slag is thus "rendered less sticky," it is stated, and the quality of the wool blown from it, is improved.—E. S.

Alloy of Aluminium and Magnesium, A New and Improved. A. G. Brookes, London. From L. Mach, Jena, Germany. Eng. Pat. 24,878, Nov. 25, 1898.

The alloy consists of 100 parts of aluminium and from 10 to 30 parts of magnesium, the exact proportions between these limits being regulated by the results required. A clean workable metal is obtained which is lighter than aluminium. In addition, copper, nickel, German silver, or other alloying metal may be incorporated in convenient quantities, or in such proportions that the specific weight of the alloy does not exceed that of aluminium. The magnesium is added, in small pieces, to the aluminium fused under potassium chloride.—A. W.

Kilns for the Treatment of Ores, Ceramic, and other Materials, Impt. in Shaft-Furnaces and. J. Wetter, London. From P. F. E. Freundlich, Biebrich-on-the-Rhine, Germany. Eng. Pat. 6030, March 20, 1899.

In shaft-furnaces the wall is built up of two sets of hollow rings or segments, the inner walls of which are of the same diameter, the outer walls of one set, however, being of greater diameter than those of the other. The two kinds of rings are placed alternately one above the other. Cooling air circulates constantly between the fixed outer and inner walls of the set of larger rings, each ring getting an independent supply. The outer walls of the smaller rings are movable in sections, and the inner walls perforated, so that the charge inside may be examined at any height of the furnace, and the air-supply thereto increased as desired. —A. W.

Smelting Metals and other like Purposes, High Temperatures, An Improved Method of and Apparatus for obtaining, for. W. Borchers, Aix-la-Chapelle, Germany. Eng. Pat. 6060, March 20, 1899.

The fuel (coke) is placed in two vertical shafts or chambers, provided with closable hoppers and gas exits at their upper ends, and with a communicating space at their lower ends. A tuyère for the supply of compressed air or oxygen is fixed in the outside wall of each chamber, facing each other on a level with the communicating space. The coke is burnt at the lower end of one chamber, the opposite tuyère being closed, and the hot gases pass across the communicating space into and up through the coke in the other chamber to the gas exit. The action is then reversed, and the hot coke at the lower end of the second chamber is burnt, the hotter gases in this case passing into and heating the coke in the first chamber. By thus alternating the direction of combustion, a high temperature is obtained in the communicating space between. Above this is built another shaft or chamber, down which is fed the material to be fused or smelted, whilst underneath it is a small chamber and receptacle, into which the fused products fall.—A. W.

Iron and Steel, Impts. in Means or Apparatus for Use in Protecting, by Producing Magnetic Oxide thereupon. A. S. Bower, St. Neots. Eng. Pat. 15,191, July 11, 1898.

In a furnace for coating iron and steel with magnetic oxide, the operating fluid is made to continually circulate from the chamber in which the articles are treated, through a heating or cooling apparatus and back again, by means of a steam jet, fan, spiral conveyor, or other apparatus, whilst any surplus fluid is ejected at suitable points. Oxidising or de-oxidising substances, as required, are drawn in by the circulating apparatus, and made to pass through in a similar manner for the usual requirements of the process.

A separate claim is made for one particular design of furnace, which is described in detail in the specification, but the patentee does not confine himself to any one definite plan of operations.—A. W.

Steel, Improved, and Process of Manufacturing the Same. W. H. Wheatley, London. From La Société Générale des Aciers fins, Paris. Eng. Pat. 7110, April 4, 1899.

The claims are for a steel prepared with the following proportions of materials, and for the process of making it. The casting charge, apparently steel, is heated until a sample, hammered down to 6 mm. in thickness, and steeped in water, will bend clean to an angle of 45°. To the charge, 6 per cent. of ferro-manganese and about 3 per cent. of ferro-silicon are then added, and the whole is poured into a mould, at the bottom of which is aluminium mixed with 0·7 to 0·10 per cent. of pulverised ferro-chromium. The ingot of metal is then "steeped" and annealed.—A. W.

Pig-Iron containing Silicon or Phosphorus, Method and Apparatus for Reducing into "Bessemer" or "Thomas" Steel. L. Pszczolka, Vienna, Austria. Eng. Pat. 7893, April 14, 1899.

An improved method of reducing pig-iron containing silicon and phosphorus into Bessemer steel or Thomas homogeneous iron, is claimed, in which the size of the mouth of the converter is reduced by means of stationary, movable, or displaceable devices, whereby the pressure inside is augmented, for the purpose of increasing the heat of the bath. The arrangements may consist of rings or collars with reduced internal diameters, to be placed on the mouth of the converter and secured by a convenient appliance on the outside, of stationary or movable covers or valves for the same object, or of stationary spaces or plates towards which the convertor mouth is inclined when the same is to be closed, the whole of which devices are lined with fire-proof material, and may be provided with water-tubes for cooling.—A. W.

Iron and Steel, for Casting or Founding Purposes, An Improved Method and Means for Refining and Strengthening. J. Evans, Salford, and R. A. Smith, London. Eng. Pat. 8984, April 29, 1899.

Iron or steel, during any part of their conversion from one to the other, is treated with a flux mixture of oxide of lead, bicarbonate of soda, and potassium nitrate, in equal parts, or in other suitable proportions, either with or without a little bauxite or sand. The quantity employed is about $1\frac{1}{2}$ part to 178 parts of the iron, and it is added in any convenient manner, but preferably blown through the molten metal. —A. W.

Syphons for drawing off Molten Metals [Copper, &c.], Acids, and the like, Impts. in R. G. Collins, Dollar Bay Michigan, U.S.A. Eng. Pat. 9968, May 11, 1899.

See under I., *page* 738.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

PATENTS.

Electrodes [*Aluminium*] *for Batteries, Impts. in.* G. Heidel, St. Louis, Missouri, U.S.A. Eng. Pat. 10,119, May 13, 1899.

The patentee claims—1. "An electrode negative of grate form composed of aluminium," and (2), "An electrode negative of grate form, composed of aluminium, used in conjunction with an electrode positive, of corrugated form."
—J. C. R.

Batteries, Galvanic; Impts. in and relating to Dry and other. A. E. J. Ball, Plymouth. Eng. Pat. 14,316, June 29, 1898.

This is a zinc-carbon-manganese battery, with chlorides of ammonium, magnesium, aluminium, &c., as electrolytes, mixed with glycerin, plaster of Paris, flour, &c., for dry batteries. Other details relate to construction, sealing the cells with resin, pitch, Japanese wax, and the like.—J. C. R.

Batteries, Primary; Impts. in. W. Rowbotham, London. Eng. Pat. 14,726, July 4, 1898.

The inventor claims:—(1.) "In electric batteries, connecting a series of cells by tubes enabling the flow of liquid to take place from cell to cell, whilst maintaining electrical insulation between the cells," &c.

2. "In primary batteries, a siphon tube" to join "the exciting fluid compartments each to the next lower in the series," this siphon "being so arranged that the liquid passes over from one cell to the other, intermissions being caused by bubbles of the gases."

Previous Patent, 2378 of 1897 (this Journal, 1898, 465).
—J. C. R.

Batteries, Secondary, or Electrical Accumulators, Impts. in. O. Behrend, Frankfort-on-the-Maine, Germany. Eng. Pat. 17,268, Aug. 10, 1898.

The claim is for "An electrical accumulator, or secondary battery, wherein the space between the electrodes is filled with glass in such a state of division that, whilst it is not sufficiently fine to cause the formation of a viscous mud in the battery, it is capable, if some of the liquid be drained off after charging, of retaining such an amount of such liquid as will permit of the proper action of the battery."—J. C. R.

Batteries, Primary Electric; Impts. in. A. E. Beadle, Belvedere, Kent. Eng. Pat. 17,458, Aug. 13, 1898.

3. "A battery in which iron is the electro-positive element, divided by a porous partition, in which ferric chloride is placed in the electro-negative side, and air, chlorine, manganese dioxide, or other suitable agent is used to regenerate the ferric chloride when reduced."—J. C. R.

Peroxides, Impts. in the Manufacture of. H. Blumenberg, junr., Wakefield, New York, U.S.A. Eng. Pat. 19,446, Sept. 13, 1898.

The apparatus consists of a cell or vessel containing an electrolyte capable of yielding oxygen on decomposition, and in which the required peroxide is insoluble. On the bottom of the cell is placed a metallic plate connected to the positive pole of a source of electricity, and on this plate is a layer of litharge or other metallic oxide, above which is suspended a perforated plate connected to the negative pole. On the passage of the electric current, the oxide is uniformly peroxidised.—G. H. R.

Electrolytic Apparatus, Impts. in. [*Bi-polar perforated Electrodes.*] M. Haas, Aue, Saxony. Eng. Pat. 10,215, May 15, 1899.

In this process the electrolyte is alternately separated into two different streams, and afterwards reunited by the employment of bi-polar electrodes which contain openings arranged alternately in the middle and at the sides; or, the perforations may be alternately arranged in slanting directions in the middle and at the sides of the intermediate electrodes, the object being to obtain a good mixture of the circulating liquid.—G. H. R.

(*B.*)—ELECTRO-METALLURGY.

PATENTS.

Electro-Plating Process and Apparatus therefor, Improved. E. L. Dessolle, Fontenays Bois, France. Eng. Pat. 10,317, May 16, 1899.

The article to be plated is thoroughly cleaned, touched up, submitted to a sand blast, then given a preliminary plating in an alkaline or neutral bath, after which the surface irregularities are filled up, and a second plating is given in an alkaline or neutral bath before the article is given its final plating in an acid bath. At the bottom of the plating vessel is a serpentine or coiled pipe, either perforated or provided with nozzles, and communicating with an upper reservoir. The overflow from the plating vessel passes into a tank, provided with means for heating the liquid before it is pumped up into the reservoir, whence it descends under pressure into the plating vessel. Double anodes extending into the article to be plated may be employed to obtain a deposit of uniform thickness.—G. H. R.

XII.—FATS, OILS, AND SOAP.

Cotton-Seed Oil Fatty Acids, Action of Silver Nitrate on. E. Charabot and March. Bull. Soc. Chim. 1899, **21**, [11], 552—554.

In 1895 Dupont (this Journal, 1895, 811) discovered a volatile sulphur compound in cotton-seed oil, but did not determine its nature. The authors have therefore made a number of experiments on the subject. The fatty acids from 50 grms. of the oil were heated on the water-bath with a 30 per cent. solution of silver nitrate, and the resulting brown precipitate was washed with hot water and with alcohol, and extracted successively with petroleum spirit (ligroin), with benzene free from thiophen, and with ether. The residue was a homogeneous dark brown substance consisting principally of the silver salt of a fatty acid and of silver sulphide. This fatty acid melted at 52° C., and solidified at 49° to 50° C. It combined with ammonia to form a white salt, which, on treatment with silver nitrate, gave a brown precipitate similar to the original brown residue.

As an analogous volatile sulphur compound has been found in olive oil by Dupont and Charabot (Bull. Soc. Chim. **15**, 341), the authors point out that great caution is necessary in accepting the results of the silver nitrate test in the detection of cotton-seed oil in olive oil.—C. A. M.

Petroleum Oils: Viscosity Determinations. D. Holde. Mitth. k. techn. Versuchsanstalt zu Berlin, **17**, [1 and 2], 62.

See under III., *page* 749.

Sesame Oil, Notes on Baudouin's Reaction for. W. Kerp. Zeits. f. Untersuch. Nahr. u. Genussmittel, 1899, **2**, [6], 473.

See under XXIII., *page* 790.

PATENTS.

Oils, Drying, and their Fatty Acids, A Process for the Rapid Oxidation of, by Mixing and Airing the same with Pulverised Substances for the Preparation of Linoleum and Cork Sheeting. J. Hertkorn, Berlin. Eng. Pat. 7242, March 25, 1898.

In this invention the oils are boiled either with or without the addition of oxidising agents or alkaline earths or compounds of these. The resulting mass is mixed with finely pulverised material, such as sawdust or powdered cork, and the mixture is oxidised by means of a current of air or oxygen. The cohesiveness and elasticity of the final product may be increased by the addition of finely powdered hard resin to the semi-oxidised mass, whilst an addition of oxides or soaps of the alkaline earths will prevent the spontaneous ignition of the cement. It is stated that by this method the oxidation of a large quantity of oil can be completed in a few hours.

Claim is also made for a special apparatus in which this process may be carried out. The chief novelty in this is in the mixing and oxidising cylinder, which is provided with a hollow shaft with hollow and perforated revolving wings, through which hot or cold air can be automatically supplied.—C. A. M.

Fatty Matters, Impts. in the Treatment of, for Deodorising and Decolorising the same. E. Andreoli, Camberwell. Eng. Pat. 14,570, July 1, 1898.

Claim is made for the treatment of the fat with ozone in conjunction with a solution of a hypochlorite, the latter being added either in part previously, or simultaneously with the ozone. The fat must be agitated with the reagent in such a manner that the mass is in a perfect state of division without violent motion. For the production of the ozone, the patentee employs an apparatus similar to that described in his Eng. Pat. 15,813, 1897 (this Journal, 1897, 89).—C. A. M.

Oil Purifying Apparatus, Impts. in. C. Frowein, Barmen, Rhenish Prussia. Eng. Pat. 11,602, June 5, 1899.

The apparatus described in this patent is intended for the purification of waste oil ("drop oil") from bearings and other parts of machinery. It consists of a vessel of cylindrical or other suitable form, provided at the bottom of its upper part with a flange or projections on which rests a sieve of perforated sheet metal. This sieve supports a disc of stretched rough cotton cloth, on which are placed wood shavings or other light porous material, covered by a second disc of cotton cloth. This packing of alternate discs and porous material is repeated until the filter bed is of the required thickness. A second sieve crowns the whole and a weight is placed on this to compress the filter. The lower part of the vessel, which receives the filtered oil, is provided with a cock.—C. A. M.

Expressing Liquids from Solids [Cotton Seed, &c.], Impts. in Apparatus for. L. Baggett Jackson, Mississippi, U.S.A. Eng. Pat. 11,771, June 6, 1899.

See under I., *page* 738.

Soap; Impts. in and connected with Soap Frames used in the Manufacture and Slabbing of. H. Hadfield, Whaley Bridge, Chester. Eng. Pat. 15,833, July 20, 1898.

The improvements described in this specification have reference to a former patent (19,903 of 1896, this Journal, 1897, 811). The false bottom of the frame is here raised by a screw-shaft operated by means of gearing, whilst the slabbing is effected by means of a frame provided with cutting wires, and sliding on rails.—C. A. M.

Soap, Impts. in the Manufacture of. J. McNeill, Glasgow. Eng. Pat. 17,842, August 19, 1898.

In the process claimed, refuse tallow is mixed with fish, nut, or seed oil (say in the proportion of 1 lb. to 1 gall.) and the mixture boiled in the soap pan with about half its quantity of "potassa liquor" containing 6,000—7,000 grains of "real potassa" per gallon. When the liquid has the appearance of thin glue, a further addition (about 12 per cent.) of a stronger lye (8,000—9,000 grains per gall.) is made, followed by a similar quantity after a short interval, and so on until the amount of alkali required for the saponification has been introduced.

The resulting soft soap is run into a large pan containing additional alkali (say, soda crystals in the proportion of about 25 per cent. of the soft soap) previously heated to its melting or boiling point. The mass is kept in constant agitation and any desired perfume introduced together with from 7 to 14 lb. per ton of "lithophone white." The stirring is continued until the mass has set and the resulting white soap is allowed to stand over night. Special claim is also made for the manufacture of white soft soap as described above, from ordinary soft soap.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

PATENT.

White Lead, Paints and other Substances, Impts. relating to Mills, Mixing and Grinding, for the Manufacture of. T. and T. R. Torrance, Bilton, Gloucestershire. Eng. Pat. 10,107, May 13, 1899.

See under I., *page* 738.

(*B.*)—RESINS, VARNISHES.

Coal and Ambrite, New Zealand; Results of the Analysis of Samples of, and of Barbados Manjak. P. P. Bedson. Trans. North of England Inst. of Mining and Mech. Eng. 1899, **48**, [3], 82—87.

See under II., *page* 738.

The Manjak Industry in Barbadoes.

See under Trade Rep., *page* 798.

PATENTS.

Copal Varnish and other like Varnishes, Impts. in the Manufacture of and Solvents applicable therefor. S. Banner, Liverpool. Eng. Pat. 9028, April 29, 1899.

In making varnish, the copal, asphalt, or the like, is fused in the usual way and linseed oil added. When sufficiently boiled, the mass is cooled down to 240°—270° F. and a hydrocarbon added (preferably of the olefine, paraffine or terpene series), having a boiling point slightly above this temperature. This mass is then cooled down to ordinary temperature without solidifying, and is then stirred up with "a mixture of hydrocarbons of comparatively high and low boiling point," such mixture "having a higher flash point and specific gravity than the mean or average of its constituents, whereby light hydrocarbons can be added without danger or loss, and a better solvent and drier obtained."
—S. K.

Siccative Oil, Manufacture of, mostly from Petroleum. W. L. Sluyterman van Loo, Tilbury, Essex. Eng. Pat. 9689, May 8, 1899.

In this invention, resin is melted into heated petroleum in the proportion of about 75 parts to 100; from 2 to 5 parts of an oxide of an alkaline earth (preferably calcium oxide), are introduced with continual stirring, and finally from 3 to 5 parts of water in successive small portions. The partial or total substitution of the calcium oxide by the oxide of another metal, such as zinc, increases the drying properties of the product. This is effected by warming the oil and adding a salt of the required metal (*e.g.* zinc sulphate) which will produce an insoluble calcium salt by double decomposition.—C. A. M.

(*C.*)—INDIA-RUBBER, &c.

PATENTS.

Indiarubber, Impts. in the Method of and Means for Reclaiming, and Rendering the Reclaimed Rubber Dissolvableby Ordinary Rubber-Solvents. J. Anderson, jun., Clayton, Manchester. Eng. Pat. 18,008, Aug. 22, 1898.

A substance such as calcium sulphide is employed which will combine with sulphur or sulphur compounds at devulcanising heat. The powdered rubber is well mixed with it and then heated in a closed chamber with a solvent (coal tar naphtha).—S. K.

Caoutchouc, Indiarubber, Gum Elastic, and similar Materials, Impts. in Disvulcanising. A. E. J. V. J. Theilgaard, Copenhagen. Eng. Pats. 10,820, 10,821, and 10,822, May 23, 1899.

In Eng. Pat. 10,820 a solution of lime or another alkaline earth is used for removing the sulphur, in 10,821 a sulphhydrate or a sulphide, and in 10,822 a cyanide solution. The *modus operandi* is the same in the three patents. The materials, cut up into pieces of suitable size, are treated in "a recipient," and finally, at an elevated temperature, with the solution and then separated from the same, washed, and dried.—S. K.

Rubber Waste, Impts. in or relating to a Process for Reclaiming. A. J. Boult, London. From A. H. Marks, Akron, Ohio, U.S.A. Eng. Pat. 11,159, May 29, 1899.

The finely ground rubber waste is heated "in a sealed vessel" for about 20 hours with a 3 per cent. solution of caustic soda at a temperature of about 344° F. or a pressure of 125 lb. per square inch.—S. K.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Quebracho Tannage. W. Eitner. Der Gerber, **25**, [592], [593], [594], [595], and [596].

Quebracho has been mostly used in Austria, in conjunction with pine bark, in the tanning of sole leather. It has been found when this material is employed that the hides must be "raised" or "swollen" by the use of some souring agent, and that this "plumpness" must be maintained throughout the tanning process.

With the old method of tanning, the hides were passed through a succession of pits containing old sour tan liquors, which were never thrown away, but merely strengthened periodically by the addition of small quantities of fresh extract and bark each time a fresh pack of hides was placed in the liquor. The effect of such immersion in sour tan liquors (which lasted from 4—5 weeks) was to produce the desired swelling and colouring of the hides, or the partial tannage or "setting" of the grain. It was generally supposed that a sour liquor with little tannin would not contract the grain of the hide, in other words, that the tannin was the main cause of this contraction. It is now known that it is to the acid present, that contraction must be chiefly ascribed, aided in some degree no doubt by strong infusions of tannin.

The American tanners have indicated the rational method of colouring and swelling hides, *viz.:* by plumping the goods in a short space of time, in a perfectly pure and "sweet" liquor, moderately strong in tannin, and keeping them in a state of continual agitation by the "colouring" wheel, until they are tanned.

In the case of the new process, in which the meagre tanning extracts of pine bark have been strengthened by the addition of quebracho, the sour liquors used are much more effective. Quebracho generates only a small quantity of acid, so that the whole quantity of the latter present throughout the tanning process, is relatively very much less than was the case when pine bark alone was used.

The problem therefore to be solved is to obtain with sour liquors containing less acids and more tannin, an equal degree of plumpness in the hides. It is only quite recently that it has been possible to satisfy the desire of a tanner for a hide perfectly free from lime but, nevertheless, thoroughly plumped, *viz.*, by the use of certain substances which remove or neutralise lime. Hydrochloric acid may be used, but only in a capacious wooden vat, so that the hides may hang with space intervals of 5 cm. between each of them. One-quarter of the required quantity of hydrochloric acid is now put into the vat, with sufficient water, and the hides are suspended for six hours; another quarter of the acid is added, and the hides are again immersed, and the process is repeated at intervals of six hours, until the whole quantity of acid has been added. The quantity of acid to be used is 10 grms. per kilo. of green hide. Where a wheel is available, by means of which the liquor is continually agitated, the process of "de-liming" is much quicker. The lime stock treated in this manner begins to swell, and plumps without becoming flaccid, so that the hides, though soft, are nevertheless firm in texture, the grain smooth and even, and in this condition they may be introduced without washing, direct into the liquors. The first liquor should be at from 10°—12° B. They are moved on through a series of gradually stronger pits for about 20 days, and handled regularly. At the end of this time the grain is thoroughly set, the goods are firm and coloured through, and they are in a suitable condition to go into layers. A suitable strength for the layer liquor is about 15½° B., and should consist of about three-quarters of acid liquor and one-quarter of fresh liquor, and the goods should be dusted down with 3 kilos. of coarsely ground pine bark per hide. The later layers may have 10—15 per cent. of quebracho added, with pine bark as dusting material.—J. G. P.

Dongola, The Manufacture of. Leather Trades Rev. 1899, **32**, 689.

For the manufacture of this variety of leather, green salted hides are perhaps the best, but dry hides may be used successfully. Great care is necessary in the "beam house." The hides must be thoroughly softened and properly handled. A brief liming is most successful, satisfactory results being obtained with 150 lb. of lime and 15 lb. of sodium sulphide to every 1,000 lb. weight of dry hides. After the usual fleshing, unhairing, washing and bateing, the hides are then washed. They are now "pickled" in a preservative made as follows:—500 gals. of water, 400 lb. of salt and 35 lb. of sulphuric acid. This is thoroughly stirred until the salt has dissolved. The skins are then put in and occasionally handled, and left for from 4—5 hours. They are next placed in a gambier liquor of about 6° Bk.* [Barkometer], to which 10 lb. of alum and two-thirds this quantity salt have been previously added to every 100 galls. of the liquor. The skins are left in this for three days, the liquor being strengthened each day. They are then split or shaved. They now go into a second liquor without alum or salt, the strength of which is judged by the effect upon the pelt. The usual strength is from 18—20° Bk., the goods remaining there for about three days. They are next drained and treated with a liquor, consisting of 3 gals. of neat's foot oil to every 100 lb. of leather, and slowly dried. The leather is then damped for "stuffing," for every 100 lb. of dried leather, 5 lb. of French dégras, 3 lb. of cod oil, 3 lb. of neat's foot oil, and 2 lb. of paraffin oil being used. The stuffing oil is heated to between 80° and 90° C., the skins are turned in this for about 20 minutes, a small quantity of warm water is added, and they are then taken out and blacked, dried and damped back for staking on the flesh side. They are finally ironed, if finished "in the dull." If bright finishes are desired, they should be seasoned and glazed. A good dull finish can be obtained by using the following preparation:—in two quarts of logwood, 2 oz. of gelatin are dissolved, ½ oz. of brown glue, 1 pint of vinegar, ½ oz. of glycerin, and ½ oz. of potassium bichromate. For a seasoning preparation in bright finish, boil ½ lb. of linseed oil in six quarts of water, and of this take ½ pint and mix it with ½ gal. of blood, one quart of sweet milk, 1 lb. of strong logwood, and ½ oz. of Nigrosine Black. After application, hang in a warm room, and then glaze. The goods are finally finished with equal parts of neat's foot oil and olive oil.

—J. G. P.

Tanning Liquors, Testing the Acidity of. Paessler and Spanjer. Zeits. angew. Chem. 1899, 27, 636—638.

The following method is proposed by the authors as being very rapid and sufficiently delicate for the control of the acidity of tanning liquors in practice:—25 c.c. of the liquor is treated in a beaker with a sufficient quantity of gelatin solution, say 25 c.c. of a solution of 2 grms. of gelatin to a litre of water. A standard solution of barium hydroxide is then run in and the point of neutrality is observed by spots on good sensitive litmus paper. The acidity is then calculated as acetic acid in grms. per 100 c.c. of the tanning bath. Any slight acidity of the gelatin solution can easily be corrected through the medium of a blank experiment. Experiments made for testing the accuracy of this method gave maximum differences of $\pm 2 \cdot 3$ per cent. of the acid added, an error which is quite unimportant when the small amount of acid present in the liquors is considered.—J. F. B.

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* 6° Bk. = 1·006 sp. gr.; 60° Bk. = 1·060 sp. gr. and so on.

Leather, Chromed, in Germany. Foreign Office Ann. Series, No. 2312, July 1899.

See under Trade Rep., *page* 795.

XV.—MANURES, Etc.

Nitrification of Organic Nitrogen. V. Omelianski. Centralbl. für Bakteriol., II. Abth. 1899, **5**, [13], 473—490.

The author concludes from his experiments that pure cultures of the nitrifying bacteria have absolutely no action upon the nitrogen of organic compounds, no matter how this nitrogen is combined. This negative result is not due to too high a concentration as has been suggested. For the oxidation of the nitrogen of organic compounds, it is indispensable that this element should first be converted into ammonia by the co-operation of at least one organism capable of effecting the ammoniacal fermentation of organic compounds. The contrary conclusions of Frankland, Warington and Stutzer are, it is alleged, based on errors of observation. The author confirms his negative conclusion by a very complete series of synthetical experiments. He took pure cultures of *B. racemosus, nitrosomonas* and *nitrobacter* and sowed them in combinations in ordinary alkaline bouillon. With *B. racemosus + nitrosomonas + nitrobacter*, the nitrification proceeded through ammonia and nitrous acid, completely to nitric acid. With *B. racemosus + nitrosomonas* the action stopped at nitrous acid. With *B. racemosus + nitrobacter* only ammonia was formed, because the absence of the nitrous forming organism gave no food for the nitric organism. Lastly, with *B. nitrosomonas + nitrobacter* no action whatever occurred even after ten months.—J. F. B.

PATENTS.

Superphosphates and other Chemical Manures, Impts. in Apparatus for the Manufacture of. D. Crawford, Newcastle-upon-Tyne. Eng. Pat. 7974, April 15, 1899.

"The material is delivered from the ordinary dissolving tank into a series of flat, open, shallow trays carried upon a conveyor formed of an endless chain or chains, travelling intermittently over tumblers from back to front within a closed chamber, in which the material gives off its gases, and is delivered into the open air, and is there broken up by the workmen and delivered, the empty trays travelling back to be recharged; the material being afterwards treated in a disintegrating screen, and, if required, taken to a drying machine." The gases given off by the material while traversing the closed chamber are drawn out by exhaust fans or otherwise.—E. S.

Superphosphates, A Process and Apparatus for Comminuting or Disintegrating. A. G. Brookes, London. From Chemische Fabrik Actiengesellschaft vorm. C. Scharff and Co., Breslau, Germany. Eng. Pat. 9260, May 2, 1899.

The superphosphate is conveyed by a feeding device from the decomposing chambers to a hopper, the discharge orifice of which is closed by a cutter barrel, kept in rapid rotation. The cutters are arranged after the manner of a grating around the periphery of the barrel, so as to cut the superphosphate into thin layers. The thin sheets or shavings of superphosphate thus formed crumble to a fine powder, this result being aided by the blast of air caused by the rotation of the barrel. Deflectors are pivoted to ribs set at the requisite angle, which, being fixed, compel the wind to deviate from its tangential course, thus enabling the powder to drop into the tilting wagon at a regular speed. Also, it is stated, "the fan-like operation of the barrel affords the material advantage that the noxious gases escaping from the superphosphate, and any impurities in the form of dust, are gathered up by the suction and carried off into the atmosphere" to the advantage of the workpeople.—E. S.

Superphosphate and other Materials, A New or Improved Process and Apparatus for Drying, Cooling, and Feeding or Conveying. A. G. Brookes, London. From Dr. F. Lorenz, Hanover, Germany. Eng. Pat. 10,204, May 15, 1899.

The superphosphate is subjected on leaving the chambers to a disintegrating process, as described in Eng. Pat. 9260, 1899 [see preceding abstract], and is then passed through an inclined perforated drying floor, through which heated compressed air is passed, imparting motion to the material, whilst drying it, so that it retains only about 10 per cent. of moisture. The hot material drops from the upper trough or channel on to a second lower trough of similar construction, into the lower compressed-air chamber of which a cold blast is forced. The lower end of this second trough may be constructed in the shape of a sieve, so that cold, sifted material may be collected in a tilting wagon or in sacks. The drying floor in both troughs consists of plates, superposed or overlapping like scales, through the spaces between which the compressed air passes. That portion of the drying-floor situated in front of the compressed-air inlet pipe, is more inclined, or curved upwards, than the rest of the floor. This arrangement secures "that part of the current of compressed air is blown through such drying-floor, direct into the space wherein the material travels, and so gives the initial impulse" to its motion.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Cane, Cultivation of, in French Guiana. Du Beaufret. Bull. de l'Assoc. des Chim. de Suer. et de Dist. 1899, **16**, [12], 1189—1196.

In Guiana the only remunerative cultivation of the sugar cane, is that made on the low lands, which quickly become exhausted. In order to restore fertility to such lands, the sea is allowed to cover the ground for several years, when it is again fit for cultivation, without the use of manure. The plot selected, is drained by cutting a series of canals, the bed being slightly higher than low tide, and the sea being kept out by a sluice gate and dikes, which are higher than the highest tide. The thickness of the soil is generally 45 cm. before drying, and becomes reduced to 25 cm. in eighteen months to two years. The sub-soil, about 35 cm., is composed of black mud.

When the ground is dry, the plantation of canes is begun. Tops, of about 20 to 25 cm. in length, are used. These are placed end to end in furrows 18 to 20 cm. deep and 25 to 30 cm. wide at the bottom. If it be necessary to use whole canes instead of tops for planting, they should be cut into pieces 25 to 30 cm. in length, otherwise there is risk of the juice fermenting and becoming acid.—L. J. de W.

Sugar Cane, The Occurrence of Xanthine Bases in. E. C. Shorey. J. Amer. Chem. Soc. 1899, **21**, [7], 609—612.

On clarifying cane juice with basic lead acetate, removing the excess of lead, adding a few drops of Fehling's solution to the filtrate previously rendered alkaline, and boiling, there is an immediate white precipitate, which rapidly turns green. By dissolving the precipitate thus obtained from 10 litres of cane juice in dilute nitric acid, and adding ammoniacal silver nitrate, the author obtained a dirty-brown precipitate, which on decomposition with dilute hydrochloric acid, yielded crystals of guanine hydrochloride, but no other xanthine body in any quantity.

Guanine was also the only xanthine body found in ten other samples of cane juice, and four samples of refuse molasses, and hence the author concludes that it is the principal, and probably the only xanthine base in the mature sugar cane.

He has attempted to estimate its quantity by precipitating it as described, with Fehling's solution, washing the precipitate with hot water, determining the nitrogen it contains, and calculating the result into guanine. An average of six samples of juice of approximately the same composition and degree of purity, gave the following results:—Total nitrogen, $0 \cdot 0350$; guanine nitrogen, $0 \cdot 0012$; and calculated guanine, $0 \cdot 0025$ per cent.

From the known properties of guanine it was anticipated at the base would be unchanged in the process of the anufacture of sugar, but that since a certain proportion of e other nitrogenous compounds are removed, the ratio of tal nitrogen to guanine nitrogen would be higher in the efuse molasses than in the original juice. This was found be the case, the average of four samples of refuse olasses giving the following results: — Total nitrogen, ·7140; guanine nitrogen, 0·0308; calculated guanine, ·0660 per cent. In the samples of raw juice the ratio of tal nitrogen to guanine nitrogen was as 100 : 3·42, whereas the molasses the ratio was 100 : 4·31.

In the author's opinion the amount present in refuse olasses is worthy of note in taking into consideration its ertilising or food value.

With reference to the influence of guanine in the analysis f sugar products, he points out that its presence may lead o errors unless an allowance be made. Thus in the estimaion of reducing sugars, if the gravimetric method be used, nd the precipitate reduced in a current of hydrogen, the uanine precipitate is not attacked and will be weighed as opper. In the volumetric process this objection does not ccur, since the amount of copper precipitated, is not ffected. It is, therefore, advisable, where a gravimetric stimation of reducing sugars is required, to determine the opper electrolytically.

As guanine is partially precipitated by phosphotungstic acid, there is a possibility of the guanine nitrogen being attributed to proteid bodies. This, however, may be obviated by preliminary treatment with sulphuric acid, and filtration before the addition of the reagent.

Taking into account the fact that guanine is precipitated by mercuric nitrate, the formation of a precipitate on the addition of that reagent cannot be regarded as proof of the presence of amide bodies.—C. A. M.

Cane Molasses and Various Products of Cane Sugar Factories, Composition of. H. Pellet. Bull. de l'Assoc. des. Chim. de Sucr. et de Dist. 1899, **16**, [12], 1145—1188.

After fully examining the results obtained by many observers, the author draws the following conclusions with regard to the analysis of cane molasses :—

Cane molasses contains reducing substances formed of levulose, dextrose, mannose, and glutose, the first two predominating. The possible presence of pentosans may likewise require attention.

The levulose is usually present in greater quantity that the dextrose, so that the reducing substances are lævo-rotatory. It is rare that the polarisation of the reducing substances is zero, and rarer still is it dextro-rotatory.

Basic acetate of lead acts on levulose and dextrose, partially precipitating them, especially in the presence of salts, as in molasses. Levulose is precipitated in greater quantity than dextrose. The polarisation of the remaining levulose is also affected, the direct polarisation being increased towards the right. This affects the determination of the rotatory power of the reducing substances.

The direct polarisation of cane molasses may be obtained by using chloride of lime for clarifying.

The Clerget inversion gives the real crystallisable sugar substances such as dextrose and levulose &c., pre-existing in the solution not being modified sensibly by the inversion, under the conditions in which it is carried out. On adding pure invert sugar, levulose, or dextrose in variable quantities to a solution of crystallisable sugar, the direct polarisation corresponds to the difference between the rotations to the right and to the left, and the inversion, affecting only the crystallisable sugar, allows of the calculation of the exact proportion.

The determination of crystallisable sugar by inversion is confirmed by the determination of the same sugar directly, after destruction of the reducing substances, or finally, by determining the alcohol after fermentation.

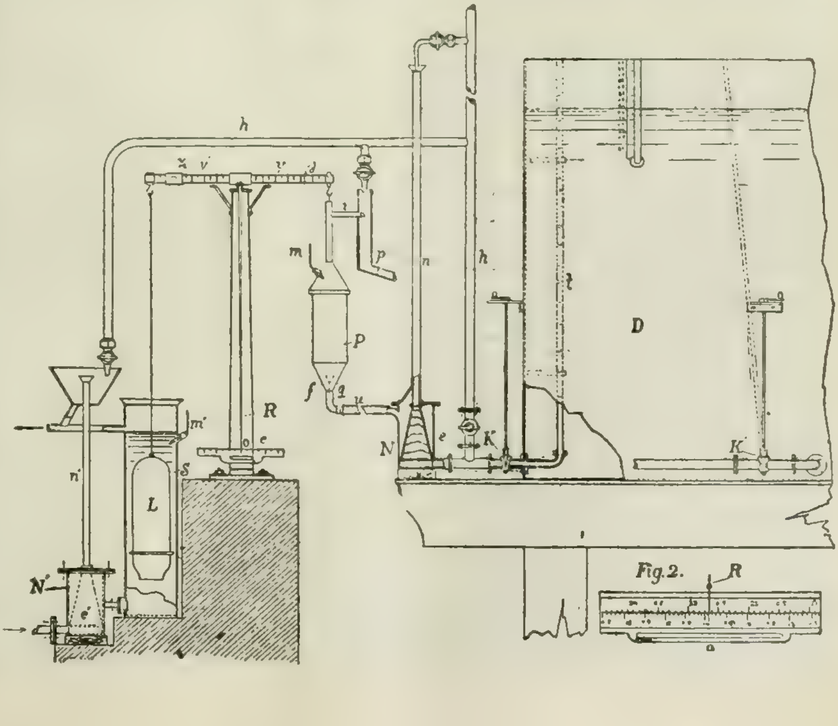
In the fermentation of cane molasses, a small quantity of non-fermentable matter (from 1·5 to 4 per cent.) is left. As the reducing substances amount to 12 to 25 per cent. of the molasses, it is evident that only a small part of the reducing substances is non-fermentable, even assuming that these reducing substances remaining do not arise from the crystallisable sugar, which is probably not the case, since with crystallisable sugar, alone or inverted, a little reducing substance is left after fermentation.

When the exact composition of a molasses is required and the rotatory power of its reducing substances, it should be examined for glutose and mannose, and these should be determined. Cane molasses may contain 0·1 to 0·5 per cent. of mannose, and 2 to 3 per cent. of glutose.

—L. J. de W.

Diffusion Juice, Apparatus for the Estimation of the Correct Withdrawal of. F. Berounsky. Zeits. für Zuckerind. in Böhmen, 1899, **23**, [10], 655—664.

This apparatus is an automatic sampler which measures the density of the juice passing through it. The density varies with the quality of the beets, and can be kept approximately constant by regulating the quantity of juice withdrawn from the diffusers at each charge, in accordance with the indications of the instrument. The apparatus (see figure) consists of a vessel P of known capacity, which is kept filled with diffusion juice from the tanks D by means of pipes. The perforated pipe *t* in the tank collects the juice, which passes through a vessel N, in which is placed sawdust or other filtering medium, in order to destroy the foam. After deaëration in N, the juice passes through a flexible rubber tube *u* into the vessel P, and out by way of the pipe *i*, which moves up and down in a slit cut in the outlet pipe *p*. The main valves K K¹ are shut when a reading is taken. The vessel P and the liquor contained by it are suspended at the end of one arm of a balance *y y*, provided with a sliding



weight z. On the other arm is suspended a weight L, which is immersed in a vessel S, through which the waste diffusion water from the last diffuser of the series circulates, with arrangements analogous to those of the other side; *h* is a water pipe for cleansing. The difference in density between the juice and the waste water is then indicated by the pointer R on a graduated double scale (Fig. 2) on which are plotted densities below, and the corresponding amount of liquor to be withdrawn in hectolitres on the upper portion, in order to regulate a constant density of the diffusion juice. The thermometers $m\ m^1$ enable necessary temperature corrections to be made by means of the sliding weight.—J. F. B.

Sucrose, The Influence of Temperature on the Specific Rotation of, and Method of Correcting Readings of Compensating Polariscopes therefor. H. W. Wiley. J. Amer. Chem. Soc. 1899, **21**, [7], 568—596.

The author has made a series of determinations of the rotatory power of a sugar solution at temperatures ranging from 4° to 40° C. Throughout the experiments the same solution of syrup was used, and the readings were made in triplicate, one set with the white light telescope, one with the yellow light telescope, and one by inserting in the instrument a left-handed quartz plate of known value.

In determining the change in polarisation due to the influence of temperature on the specific rotation, other influences were eliminated or allowed for, such as variations in the size of the flask and length of the tube for the different temperatures, changes in the compensating powers of the quartz wedges, and changes due to pressure on the quartz plates and wedges.

From the results of the investigation the author finds that the mean rate of increase in the rotatory power is not the same at every temperature. Thus, for instance, it appears to be greater from 15° to 17·5°, from 20° to 25°, and from 30° to 35° C. than at the other points at which the readings were taken. But he considers that further observations are required to definitely settle this point.

The mean magnitude calculated for the variation of each degree was 0·00994, which is somewhat lower than the value given by Andrews (0·01140) and by Schönrock (0·01440).
—C. A. M.

Sugar, Iodometric Estimation of, by Means of Fehling's Solution. N. Schoorl. Zeits. angew. Chem. 1899, [27], 633.

See under XXIII., *page* 791.

Beet-Sugar Industry of Germany from 1877 *to* 1899. U.S. Cons. Reps., July 1899, 471.

See under Trade Rep., *page* 795.

PATENTS.

Sugar, Improved Process and Apparatus for the Rapid Refining of. J. Robin-Langlois, Paris. Eng. Pat. 16,540, July 29, 1898.

The essential parts of the operation are as follows:—

Cleaning from fibres, dust, &c., by any known method, preferably by blowing air across a stream of sugar falling from a hopper on to a series of inclined boards.

Crushing and Grinding by any machine which gives uniform results.

Treatment with Steam or Spray in order to introduce a definite small proportion of moisture, and to brighten the facets of the small crystals. This operation is performed in the mixer for the sake of uniformity. Jets of steam or atomised water impinge against angle plates, whence they rebound on to the sugar falling from the supply tube in two streams into the mixer.

The Mixer is essentially an annular space between two concentric hot-water jackets, the rotating blades and sugar being contained in this space at a desired high temperature. The discharge hole of the mixer stands above an annular trough in a revolving circular table, the circumferences of the two machines intersecting to the necessary extent.

The Circular Table contains on its periphery a trough across which are arranged radially the moulds in juxtaposed boxes. These moulds are open at the top, and have perforated bottoms, they are locked and disengaged, and opened by special appliances, enabling them to work continuously, and to be emptied without injury to the bars of sugar. As the annular series of moulds revolve, they pass in turn under the discharge hole of the mixer, and are filled with sugar by inclined scrapers, they then pass on, and the sugar in each mould is compressed by a corrugated roller, fixed in relation to the table, but revolving on its own axis, so that its projections correspond consecutively with each mould. At a further stage of the revolution, the moulds are automatically placed under vacuum and the syrup sucked out, and when dry they are unlocked, emptied, and readjusted continuously by devices described.

The claims, seven in number, cover the process and the mechanical details of the apparatus employed.—J. F. B.

Fecula and other Amylaceous Matters, Treatment of, by means of Alkaline Chlorites or Hypochlorites for the Purpose of obtaining a Gummy and Gelatinous Product. C. Brueder, France. Eng. Pat. 17,650, Aug. 16, 1898.

The process claimed, consists in the treatment of neutral feculæ and starches, or such amylaceous substances, neutralised, preferably by means of peroxide of sodium, with alkaline chlorites or hypochlorites, preferably sodium or potassium hypochlorite, without the aid of any other chemical agent. For this purpose, 1,000 parts of starch are mixed with 800—900 parts of water containing 100 parts of chlorite or hypochlorite, and allowed to stand. The liquid is then decanted off, and the sediment dried and heated in a stove for some hours at 50°—100° C. The product claimed has a good white colour, and is soluble in water like gelatin, for which it is intended as an industrial substitute. No trace of free chlorine can be detected in the product, which, when heated with water, forms a glue which thickens at first and then becomes fluid.—J. F. B.

Syrup, Molasses, and the like, Impts. in the Purification of. J. C. Boot, Java, through W. P. Thompson. Eng. Pat. 18,143, Aug. 23, 1898.

The claims relate to a process for the decolorisation of syrups, molasses, and saccharine liquids by the addition to the said liquids of zinc and sulphurous acid, forming hydrosulphurous [hyposulphurous] acid, the precipitation of the zinc by means of a soluble ferrocyanide, and filtration of the ferrocyanide of zinc from the decolorised product. The application of hydrosulphurous acid prepared separately by means of zinc and sulphurous acid, or by any other method, for the treatment of saccharine liquids is also claimed. The liquid is preferably treated in motion at a density not exceeding 50° B., decolorisation being effected at 50° C., and precipitation of the zinc at 70°—90° C.
—J. F. B.

Sugar Molasses or Syrup, Impts. in or relating to the Treatment of, by means of Lime. M. B. Zahn, Germany. Eng. Pat. 8222, April 19, 1899.

The inventor claims a process of precipitating sugar from molasses or syrup solutions by means of "caustic" [quick] lime, characterised by the caustic lime being introduced into the solutions in a powdered, finely-divided state, so that each particle is applied to and taken up separately by the liquid, which is kept in motion. The apparatus claimed, consists of a vessel containing the syrup, provided with a stirrer and cooling device. Over this is placed a cylindrical sieve, into which the lime flour is fed from a hopper, and through the fine meshes of which it is dusted on to the surface of the moving liquid. The sucrate of lime so produced is said to be in a granular condition, uniform, and easily treated.—J. F. B.

Starch, Impts. in the Manufacture of Laundry. M. D. Petersen (*née* Christiansen), N. Schleswig. Eng. Pat. 11,416, June 1, 1899.

The claims relate to an improved laundry starch, and the process for preparing it, consisting in mixing in suitable proportions sago flour, common salt, and dextrin in the dry state, then stirring the mixture, first with a little cold water and then with boiling water. Five parts of sago flour, 2 parts of salt, and 1 part of dextrin form a suitable mixture.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Steeped Barley, Relation of Water Content to Vegetation of Germ and Modification of Matter in. K. Michel. Allgem. Anzeiger für Brau. **15**, [17], 633—636.

From experiments extending over a long period, the author concludes that barley for malt intended for the Bavarian type of beer is sufficiently steeped when the content of moisture does not exceed 46 per cent. (maximum). When, however, the malting floor is made of material of low absorptive capacity, a lower percentage of moisture will suffice, but this should not fall below 42 per cent. for brown malt, or exceed 38 per cent. for pale malt. A low water content is preferable to the other extreme, since it can be remedied by sprinkling the malt when on the floor.

He also finds that the water entering into combination with the materials of the barley grain in the steeping process, does not effect any change in the starchy matters or fat, but is concerned in the production of diastase, and that this enzyme is present in sufficient quantity to saccharify the starch in the grain by the time the radicle has attained one-third of the length of the corn and the acrospire has become decidedly visible, *i.e.*, about the third day of germination.

The aroma of malt he ascribes to modifications of nitrogenous matter during kilning, and not to any change of the fatty constituents, since, contrary to the results obtained by Habich, he has found that the aroma is not affected by the removal of the fat before kilning.—C. S.

Malt Analyses during the Campaign 1898–99. O. Reinke. Woch. für Brauerei, 1899, **16**, [295], 341—342.

The author gives a table of malt analyses from barleys of known origin. The analyses were made with very fine meal, but for the sake of comparison the extract yields were also determined with coarse grist in some cases. The author again emphasises his previous statements (see this Journal, 1898, 1193) as to the relations between the results obtained by analysing coarse and fine meals respectively. With fine meal, a comparison of the laboratory results with those on the large scale, gives a good idea of the quality of the malt, but the laboratory yield alone is no criterion. With coarse grit, however, the yield is higher the better the transformation during malting, and the effect of the malting process on the analysis diminishes, the finer the sample is ground. Consequently a malt should only be considered good if the yield of extractive as determined with fine and coarse meal, are nearly identical. In the present campaign the acrospire was often abundantly developed, and compared with the percentage of maltose, the true attenuation was rather higher than usual. Pale malts have been far more numerous than dark ones, so that the production of dark beers will decrease still further. The malts from Saxony have been exceptionally good this year.—J. F. B.

Yeast, Formation of Glycogen in Expressed Extract of. M. Cremer. Ber. 1899, **32**, [12], 2062—2064.

The extract expressed from very fresh yeast generally contains a distinct quantity of glycogen, but after remaining at the ordinary temperature for 6—12 hours, the glycogen reaction disappears. The author finds that, if 10 per cent. or more of fermentable sugar be added to such extract after the disappearance of the glycogen, the latter can again be detected after 12—24 hours. This result was observed in four cases, whilst four others yielded negative results. The best conditions for the re-formation of the glycogen are, yeast as fresh as possible, and a temperature of 10°—12° C.; the maximum reaction was obtained with 30 per cent. of levulose, after 60 hours' digestion. The re-formed glycogen differs from that originally present in the extract in its slighter opalescence. The author gives his reasons for believing it to be a true glycogen reaction, and not due to dextrin, although he has not been able to obtain commercial yeast entirely free from starch. He concludes that, if the expressed extract be possessed of "life" in any way, the formation of glycogen from the sugar added is readily explicable, but if it be simply a solution of unorganised ferments, the presence of a synthesising enzyme must be assumed. In either case a conversion of levulose into dextrose must be a preliminary step in the formation of glycogen from the former sugar, which circumstance indirectly supports his theory that only dextrose and its derivatives are fermentable sugars.—J. F. B.

Trehalose, The Fermentation of. A. Bau. Woch. für Brauerei, 1899, **16**, [22], 305—306.

The author confirms the results of Kalanthar (this Journal, 1899, 60), that the hydrolytic effect of the enzymes of various yeasts on trehalose proceeds very irregularly. Using Frohberg bottom-fermentation yeast under conditions similar to those of Kalanthar, the author obtained evidence of hydrolysis in three experiments out of five. In the two experiments which yielded negative results, the enzymes invertase and melibiase were proved to be in an active state, showing that these are not concerned in the hydrolysis of trehalose. Preparations of invertase were found to be without effect on trehalose. Trehalose was fermented by the top and bottom fermentation varieties of Frohberg and Saaz types, by Logos, *ellipsoideus II.*, *Pastorianus I., II., and III.*, and by *Monillia candida*, whilst a lactose yeast only fermented it very slightly, and Pombe and *S. apiculatus* had no effect whatever. When fermentation took place at all, it always started very slowly, and proceeded sluggishly to the end; the course of the fermentation reminded the author of that of cane sugar by *M. candida*. When the trehalose was only partially fermented, the remaining sugar was non-reducing and unhydrolysed. In the case of *M. candida*, Fischer and Lindner have suggested that the agent inverting cane sugar is not a soluble enzyme, invertase, but probably a constituent of the protoplasm of the organism. The author thinks that a similar explanation is reasonable as regards the behaviour of the hydrolytic principle of yeasts to trehalose; being a constituent of the living protoplasm, this principle would be far more sensitive to external conditions than an ordinary enzyme.—J. F. B.

"Invertine" [Invertase], A Contribution to the Study of. W. A. Osborne. Chem. News, 1899, **79**, [2064], 277–280.

Several methods for the preparation of invertase are described by the author, but the following process gives the most satisfactory results. Yeast (500 grms.) is extracted with absolute alcohol (500 c.c.), then dried at a gentle heat, ground to powder, and again extracted with chloroform water (300 c.c.) at 35° C., for six days. From the aqueous extract invertase is separated by precipitation with a large excess of strong alcohol. The crude ferment still, however, contains much ash (50 per cent.) rich in P_2O_5, K_2O, MgO, &c., and requires purification. To this end the invertase is dissolved in water and treated with ammonia and "magnesia mixture" in slight excess (ammonia does not destroy or injure the ferment), whereby the earths and P_2O_5 are precipitated. The filtrate is dialysed until free from chlorine, finally evaporated down *in vacuo* at 30° C. to a syrupy consistency, and the invertase precipitated by alcohol and ether and dried *in vacuo*. The invertase thus obtained contains 5 to 6 per cent. of ash (in one case only 1·83 per cent.) and forms a very light greyish powder, readily soluble in water, and "possessing invertive powers of a high order." The solution is not coagulated by boiling and is not precipitated by mineral acids, tannic or picric acid in the presence of acetic acid, mercuric chloride, ferro- or ferricyanide of potassium and acetic acid, neutral salts (Na_2SO_4, &c.) in excess in presence of an acid, or by potassio-mercuric iodide and HCl. Invertase is precipitated by lead acetate and by phospho-tungstic or phospho-molybdic acid in presence of a mineral acid. As regards colour reactions, the indications obtained were:—Millon's reagent, faint; Xanthoprotein, positive; Adamkiewicz, negative; Biuret, faint; Liebermann's reaction, negative; H_2SO_4 and sugar, negative. Invertase does not reduce Fehling's solution, and gives no reaction with iodine (absence of glycogen).

As regards chemical composition, the following values are averages, and are calculated on "ash-free" invertase:— C = 44·54 per cent., H = 6·52 per cent., N = 6·1 per cent.

Its chemical composition, as also its reactions distinguish invertase very clearly from the proteids. On hydrolysis with HCl, invertase yields an acid and a reducing substance. The latter forms a crystalline osazone, m.p. 198° C.; N 15·6 per cent. (Phenylglucosazone, m.p. 205° C.; N 15·5 per cent.). It is possible that invertase belongs to a class of bodies resembling in structure *chitin*, $C_{18}H_{30}N_2O_2$ (C = 46·3 per cent., H = 6·4 per cent., N = 6·01 per cent.), which according to Ledderhose yields on hydrolysis, acetic acid and glucosamine hydrochloride.—H. T. P.

Fermentation, Alcoholic, without Yeast Cells.—IX. E. Buchner and R. Rapp. Ber. 1899, **32**, [12], 2086—2094.

The authors collected and examined the expressed extract in fractions as it left the press, starting with 1,200 grms. of pressed yeast. The first 50 c.c. obtained had a very low fermentative power, owing to dilution with the moisture of the yeast. After this the activity rose to more than double, increasing slightly between 200 and 440 c.c. At this point the cake was treated with 35 c.c. of water, and a further 160 c.c. expressed, the activity being still slightly higher. The cake was then re-triturated by hand without water, and 90 c.c. of extract were obtained of twice the activity of any of the former fractions. So far from the zymase content of the cells being exhausted after expressing 600 c.c. of extract, it was found possible with the cautious employment of water to obtain 130 c.c. more of a far more powerful extract.

On filtering the extract through biscuit porcelain and collecting the filtrate in fractions, the first 20 c.c. possessed 0·3 times the activity of the original extract, but the second and following fractions only possessed 0·1 of the original power, indicating a very rapid blocking of the pores against zymase in the first 20 c.c. In order to obtain the highest fermentative effect (at 23° C.) it was found that concentrations between 15 and 30 per cent. of cane sugar were equally favourable, but above or below these limits a considerable falling off occurred. Expressed extract when kept by itself without addition of sugar gives off variable quantities of carbon dioxide. On testing the extract from Munich bottom-fermentation beer yeast, containing minimum quantities of glycogen, the authors determined that 20 c.c. of unevacuated extract yielded a maximum of 0·06 grm. of carbon dioxide after 40 hours, and 0·1 grm. after 88 hours, without addition of sugar. The expressed extract has very little effect on starch, even at 35° C., hence diastatic enzymes are not present to any considerable extent, at any rate in the Munich yeast employed. Soluble starch and dextrins, on the other hand, are fermented to a fair extent. Separate experiments with glucose and fructose showed that the living Munich beer yeast, like the expressed extract, fermented these sugars with equal rapidity, results of other authors to the contrary, being attributed to the variety of yeast employed, or to the two sugars being mixed.

Addition of 2 per cent. of potassium metarsenite has no effect on the fresh normal extract, but if an equal volume of water be added at the same time the activity of the diluted extract is entirely destroyed, and is considerably decreased by only 1 per cent. of arsenite. The question is one of quantitative relations between the arsenite and the (proteïd) constituents of the extract. Dilution with heated, inactive yeast extract or with blood serum, practically nullifies the effect of the arsenite, but dilution with a solutionof egg albumin or with old yeast extract is valueless, acting like dilution with water. A protective effect, similar to that of certain albuminoids, against the action of the arsenite on the zymase is also obtainable by sugar, provided the sugar be added before or at the same time as the arsenite. But if the addition of sugar (glucose) be delayed after that of the arsenite, its protective effect decreases and becomes *nil* if two hours be allowed to elapse, and no fermentation results even in the case of undiluted extract.—J. F. B.

Fermentations, Distillery, Artificial Acidification of, by Lactic Acid. Moritz. Zeits. f. Spiritusind. 1899, **22**, [24], 215.

The author gives further particulars of facts coming within his practical experience. As before stated, the addition of $1\frac{1}{2}$ per cent. by volume of lactic acid to the "Hefengut" (= portion of mash which, in the ordinary way, is set aside to acidify naturally, and afterwards "pitched" and added to the main mash) was found to check fermentation distinctly, so that the process was not finished in 72 hours; and just before distillation the worts were still working. Portions set aside for another 24 hours lost an additional 0·6 per cent. of extract.

The slow fermentation is, no doubt, due to the destructive action of the acid on the yeast nutrients, at the high temperature obtaining in the "Hefengut." The acid rate was, therefore, lowered, and the "Hefengut" cooled to 12° B., immediately after acidification. Under these conditions, using $\frac{3}{4}$ per cent. of lactic acid (below which rate it is not advisable to go), the fermentations proceeded normally.

The author concludes, therefore, that in case of highly concentrated mashes, and 96 hours of fermentation, the higher acid rate ($1\frac{1}{2}$ per cent.) is advantageous; whereas with weaker mashes (22—24 per cent.), and 72 hours of fermentation, $\frac{3}{4}$ per cent. of lactic acid will suffice to check bacterial development. In addition, the use of yeast 24 hours old is recommended.—H. T. P.

[*Beer*], *Gluten Cloudiness in.* F. Bousquet. La Bière, **7**, [5], 65—66.

Reviewing the labours of Hosch and Kappler, the author concludes that, whilst a high nitrogen content in barley evidently favours the development of gluten cloudiness in the resulting beer, the proximate causes may differ, and that the divergent results of these workers are capable of explanation in this way.

To remove the surplus nitrogenous matters, he recommends prolonged boiling of the wort, and increased hopping, avoiding at the same time alkaline water, as this helps to redissolve the said matters after their precipitation. When the cloudiness is already in existence, filtering or the use of shavings, &c., may diminish the evil, as may also an addition of finings; and, for high-fermentation beers, a previous artificial cooling will probably be serviceable. In any case it is desirable that a stricter definition of gluten cloudiness should be arrived at, for the sake of clearness in discussing and providing a remedy for the malady.

—C. S.

Wine, Volatile Acids in. G. Morpurgo. Oesterr. Chem. Zeit. **2**, 209—211; Chem. Centr. 1899, **1**, [26], 1301.

It is known that the volatile acid which distils over with steam from the wine, does not consist exclusively of acetic acid, but it is still, in a large number of cases, maintained that the major portion of the volatile acid of wine is acetic acid. The author has found that in the ordinary methods of wine examination, besides the free volatile acid which is present in the wine, the combined volatile acid is, for the most part, set free from its compounds, passes into the distillate, and is reckoned as volatile acid. Tannic acid is not carried over by the steam. For the determination of the volatile acid in wine, the author uses a copper flask of 500 c.c. capacity for producing the steam and an Erlenmeyer flask of 350 c.c. to receive the wine. 300 c.c. of boiled water, free from CO_2, are placed in the copper flask, and 25 c.c. of wine and 50 c.c. of water in the Erlenmeyer flask. The distillation should be finished in 30—40 mins., and 250 c.c. of distillate should be obtained. The liquid in the Erlenmeyer flask should always be kept at the same level.

According to the author, wines which on distillation give more than 0·28 per cent. of volatile acid, should be diluted until they contain not more than 0·07 per cent.

The ordinary white wines of South Italy, with the exception of the perfectly white, filtered wine, always contain acetic bacteria, but, notwithstanding this, they keep well, if the natural percentage of alcohol (12—14 per cent.) is not reduced.—A. S.

Yeast as a Food Stuff and Fodder Material, Classified List of the Processes for the Utilisation of. Woch. für Brauerei, 1899, **16**, [22], 307.

See under XVIII. A., *next col.*

PATENTS.

Liquids, An Automatic Method of Controlling the Flow of, and of Estimating the Quantity which Flows, Intended more particularly for Use in Distilleries. A. P. Swan, Bandon, Ireland. Eng. Pat. 13,034, June 10, 1898.

The basis of the invention is, that liquids of known specific gravities will flow through orifices of varying shape at different uniform rates of speed, which are proportionate to the area of the orifices and the pressure of liquid upon them. The claims comprise "the use of a columnar slot orifice" which allows of the control (of the flow of a liquid) "in a very restricted vertical space." "The use of an internal obstruction bolt and of moveable plates, which admit of rapid adjustment of orifice and slot for purposes of control." Also, "the use of interchangeable plates of known areas for the purpose of measuring against time, when fixed to a similar instrument, and used instead of, or in conjunction with the adjustable orifices."
—J. L. B.

Brewery and Distillery By-Products and the like Materials, Impts. in and relating to Apparatus for Drying. E. A. Hamlyn, London. Eng. Pat. 15,833, July 20, 1898.

The claims are for apparatus consisting of two heated hollow cylinders arranged side by side and geared so as to rotate together, the whole being so constructed that drying may be simultaneously effected within the cylinders and upon their exteriors.—J. L. B.

Spirits, Process for Producing in Solid Form. H. Hempel, Berlin, Germany. Eng. Pat. 1843, Jan. 26, 1899.

This "process for producing spirits in a solid form" consists in first producing a saponified mass of mutton fat or tallow and stearic acid with caustic soda, then melting the same in warm spirits of a strength of 80 per cent. or more, and afterwards casting the cooled product into convenient moulds or shapes. The resulting substance when burnt leaves a very slight residue, which sinks to the bottom of the receptacle.—J. L. B.

Spirits, Impts. in Apparatus for Solidifying. H. Hempel, Berlin. Eng. Pat. 2673, Feb. 6, 1899. (Compare previous abstract.)

The improvements comprise a steam-jacketed still provided with stirring gear connected with a vessel called a "warmer." This "warmer," which is placed at a higher level than the still, contains a condensing arrangement and means for conducting the vapour rising from the heated still to the condenser, and for retaining the level of the liquid in the condenser at a constant height. Other features claimed for the condensing vessel are, that it should have the inlet pipe and the pipe from the still taken through the cover of the latter and a pipe and outlet through the bottom of the still. These pipes are arranged in such a manner that the entering liquid will fill the vessel to the level of the overflow pipe, and then pass into the "warmer." The mouth of the vapour pipe is kept closed by the liquid in the condensing vessel until the operation is stopped, and the charge drawn off.—J. L. B.

Hops, Impts. in Apparatus for Use in Boiling and Treating. A. Müller, Berlin. Eng. Pat. 10,195, May 15, 1899.

This apparatus consists of a vessel open at its upper part and provided with a perforated bottom. The lower end rests directly on the wort copper. In the centre of the vessel is a vertical spindle carrying rakes, which move between the teeth of fixed rakes; the hops by this device are reduced to small pieces, and the lupulin is quickly set free. The spindle is fitted above the rakes with helical wings which revolve with it, and the height of the hops is maintained in the vessel. Openings are provided on the periphery for the purpose of emptying the contents into the wort copper after boiling is completed.—J. L. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Yeast as a Food-Stuff and Fodder Material, Classified List of the Processes for the Utilisation of. Wochenschr. für Brau. 1899, **16**, [22], 307—310.

The history of this subject is of comparatively recent date; the processes may be considered under three classes:—

(1.) Processes for the extraction of soluble constituents from the yeast.

(2.) Processes which utilise the whole of the yeast substance as a food.

(3.) The incorporation of yeast with fodder materials for cattle.

Apparently the first published process was an Austrian patent taken out in 1888 by Bauer, Kanis, and Jahn for the substitution of a concentrated yeast decoction for meat extract, but this was soon abandoned. A process was also described in the *Brenn. Zeit.* 1892, 1028. The first working process, being the preparation of a simple decoction of yeast after extraction of the hop bitters, was the subject of an American patent 540,471 by Wahl and Henius in Chicago; the decoction was evaporated *in vacuo* to a syrup or made up into biscuits. The next advance was made by E. Kressel, Eng. Pat. 15,885, 1895 (this Journal, 1896, 608), by which process the yeast was extracted at a temperature not exceeding 58° C., and an extraction of the coagulable proteïds was thus obtained. Subsequent processes brought about a still further utilisation of proteïds by the peptonisation of the insoluble albuminoids by means of some suitable agent. These processes are those of Peeters, Eng. Pats. 26,985, 1897; and 17,278, 1898 (this Journal, 1898, 262, and 1899, 160); Goodfellow, Eng. Pat. 13,722, 1897 (this Journal, 1898, 62); Hill-Jones and Kressel, Eng. Pats. 15,145 and 18,714, 1897 (this Journal, 1898, 785); E. Johnson, Eng. Pat. 29,183, 1897 (this Journal, 1898, 942); Denaeyer, Eng. Pat. 13,032, 1898 (this Journal, 1899, 291); C. O'Sullivan, Eng. Pat. 19,161, 1897 (this Journal, 1898, 784); and Watson, Eng. Pat. 22,846, 1897 (this Journal, 1898, 1066). The two last mark a new departure in providing for the spontaneous breaking down of the yeast cells by keeping.

To the second class belong two processes, apparently not patented, one proposed by Siebel (this Journal, 1898, 480) by which the yeast is treated with ammonium carbonate if necessary, dried and incorporated with glucose and starch; giving a syrupy mass resembling condensed milk in appearance and approximate composition; it may also be roasted for a coffee substitute. Wegener has also proposed a process for the manufacture of a coffee substitute, whereby the washed and dried yeast is roasted in presence of the aromatic vapours evolved from roasting coffee, or it may be impregnated with any other aromatic vapours for other preparations if desired.

The utilisation of yeast in fodders, if less remunerative than in human foods, is far more simple. In 1889, Pott pointed out in his book on agriculture, that the necessary conditions are the removal of the bitter taste and the killing of the yeast cells. The taste may be removed by extracting with alkaline carbonates, but since this is wasteful, it may be disguised by cooking with tasty materials. The most convenient way is to cook the pressed yeast into biscuits with a suitable proportion of fatty and amylaceous fodder-meal. Brucker (Allgem. Brauer und Hopfenzeit. 1898, 1280) states that 14 years ago he combined the excess yeast of a brewery with the hot "Schlempe" from the stills of a distillery and incorporated the mass, after boiling, with suitable fodders. Steickel, Eng. Pat. 5124, 1895, proceeds in a similar manner, using the by-products of the malt house and residues of the brewery. In the Eng. Pat. 20,060, 1893, a process is described for killing and drying the yeast simultaneously by rolling it into thin sheets between heated rollers.

In conclusion reference may be made to the abstract of Reinke's paper, this Journal, 1898, 593, and to Kusserow's, (Brenn. Zeit. 1898, 2015), especially with respect to the employment of yeast in medicine.—J. F. B.

Butter-fat, A Contribution to the Chemistry of—I. C. A. Brown, junr. J. Amer. Chem. Soc. 1899, **21**, [7], 612—633.

The following physical and chemical constants were obtained by the author in the analysis of a number of samples of butter representing for the most part the products of a herd of Guernsey cows:—

Constant.	Range.	Mean.
Specific gravity $\frac{40^\circ}{15\cdot5^\circ}$	0·9050–0·9102	0·9073
Melting point	31·6°—34·6°	33·2°
Acid value	0·20—0·66	0·50
Saponification value	224·0—234·9	228·5
Ether value	223·5—234·4	228
Iodine value	29·36—37·30	33·35
Reichert value (2½ grms.)	15·10—17·50	16·2
Reichert-Meissl value (5 grms.)	22·80—32·10	28·3
Insoluble acids, per cent.	86·03–88·84	87·65
Acetyl value	3·5 4·8	4·1
Glycerin calculated	12·24—12·79	12·46
„ by analysis	12·30—12·70	12·45
Total fat acids calculated	94·72—94·94	94·85
Soluble fat acids calculated	6·52—8·96	7·20
Specific gravity $\frac{20^\circ}{20^\circ}$ insoluble acids	0·9106—0·9242	0·9162
Melting-point of insoluble acids	40·2°—42·7°	41·7°
Saponification number of insoluble fat acids.	212·5—217·0	214·5
Mean molecular weight of insoluble acids.	258·1–263·5	261·0
Specific gravity $\frac{20^\circ}{20^\circ}$ soluble acids	0·9475—0·9483	0·9479
Saponification value of soluble acids	563·7—577·3	571·7
Mean molecular weight of soluble acids.	97·17—99·52	98·12

These constants, the more important of which were taken on 40 different samples, were determined for the most part by the usual methods. The acetyl value was determined by the original process of Benedikt and Ulzer.

When a rapid estimation of the percentage of soluble acids is required, an approximate result may be obtained by means of the following formula deduced from the data given above:—

$$V = 0\cdot0018\ [S - (188\cdot5 + \frac{228 - S}{2})] \times 100$$
$$\text{or } V = 0\cdot09\ (3\ S - 605)$$

in which V represents the percentage of soluble acids and S the saponification value. The average butter-fat has a saponification value of 228, contains 87·65 per cent. of insoluble acids with a saponification value of 215, and requires 188·5 mgrms. of potassium hydroxide to neutralise the insoluble acids from 1 grm. of fat. For any butter-fat with a saponification value S. this number was found to be about $188\cdot5 + \frac{228 - S}{2}$. Since 1 mgrm. of potassium hydroxide neutralises 0·0018 grm. of soluble acids, the difference between the saponification value of the fat, and the number of mgrms. of potassium hydroxide required to neutralise the insoluble acids, multiplied by 0·0018, gives the soluble acids in 1 grm. of fat.

The author finds that there is a certain ratio between some of the different constants. Thus in general with an increase in the saponification value, there is an increase in the Reichert value, and a decrease in the iodine value, from which the inference is drawn that there is probably a complementary ratio between the percentages of oleic acid and soluble fatty acids in different butter-fats. No definite relation could be established between the specific gravity and the melting point, although the latter showed a tendency to diminish with the rise in the saponification and Reichert values.

The occurrence of samples of abnormal chemical composition is attributed by the author to ill-health, peculiarity of diet, or an advanced period of lactation. He gives the following table comparing the generally accepted limits for three of the most important constants with those found in abnormal cases by different observers:—

—	General Limits.	Extreme Limits.
Reichert-Meissl value	20–33	11·2 (Morse); 41 (Nilson).
Saponification value	220—236	216 (Samelson); 245 (Fischer).
Iodine value	26–38	19·5 (Moore); 49·57 (Farnsteiner and Karsch).

Feeding experiments carried out by the author at the Pennsylvania experiment station have, in the main, corroborated the work of others, especially as regards the effect of different kinds of food on the proportion of volatile acids, and the iodine value. In brief, these experiments have indicated that whilst certain sorts of food, of which gluten meal may be taken as typical, have a tendency to lower the saponification value, and increase the iodine value, other sorts, such as beets, mangels, and other root products, have an exactly opposite effect.—C. A. M.

Oleomargarine, The Adulteration of, with Paraffin. J. F. Geisler. J. Amer. Chem. Soc. 1899, **21**, [7], 605—608.

On various occasions since 1893, the author has detected paraffin in commercial samples of oleomargarine, the quantity ranging from 9·72 to 11·25 per cent. Owing to the publicity given to the practice, it was discontinued to some extent until within the last six months, during which the author has again found samples containing from 5 to 11·76 per cent.

As 5 per cent. of paraffin will dissolve clear in the alcoholic soap solution of the Reichert test, that amount might escape the notice of the analyst, especially if the specific gravity of the fat were not determined. In the case of the samples which did not saponify to a clear solution, the author found the specific gravity to be abnormally low (from 0·9018 to 0·8907 at 100° F. (water at 100° F.)). The fat of one of these did not melt clear below 106°, and solidified at 105° F. The separated paraffin melted after purification at 127° F. Photomicrographs under ordinary and polarised light showed amorphous masses surrounding the crystals of fat.

In order to detect the presence of paraffin, the author recommends saponifying the fat with alcoholic potassium hydroxide, using the same proportions as in the Reichert method. The soap solution is diluted with an equal volume of water, and if 2 or 3 per cent. or more of paraffin be present, the liquid will become turbid, and by alternately heating and chilling the solution, the paraffin can be collected to a large extent. In the author's opinion, the paraffin is added with the object of improving the general appearance and consistency of the substance rather than cheapening it. Although paraffin by itself is an indigestible substance, he considers it doubtful whether under the above conditions, some of it is not absorbed into the system along with the fat. For, as he points out, the paraffin in this case is dissolved in the animal and vegetable fats of the compound, the fat mixture usually melts at the temperature of the body, and is in a highly emulsified condition. Hence, in his opinion, there are at present no data to warrant the statement, that paraffin thus taken has an injurious effect on the system.—C. A. M.

Lemonade, Analyses of. Frehse. J. Pharm. Chim. 1899, **10**, [1], 13—16.

Analyses are given of 31 samples of aërated lemonade made and sold in the town of Lyons. All contained tartaric acid, four were flavoured with traces of essence of citron, 27 were sweetened with cane sugar, and four contained saccharin. The author states that "Saponine" is occasionally added to lemonade to produce a lasting froth. It may be detected by this characteristic alone. Chemically, "Saponine" is recognised by the violet coloration obtained by evaporating the lemonade, extracting the residue with acetic ether, filtering the extract, again evaporating, and adding a drop of concentrated sulphuric acid to the final residue. Further, on boiling the latter residue with hydrochloric acid, sapogenine is precipitated, and an odour of cedar wood is developed.—W. P. S.

Alimentary Pastes in France, Wheat for. U.S. Cons. Reps., July 1899, 468.

See under Trade Rep., *page* 798.

PATENTS.

Fish Food Preparations, Impts. in. J. Davidson, London, and G. Davidson, Caithness. Eng. Pat. 13,367, June 15 1898.

According to this patent, white fish, after the removal of scales and bone, are cooked in an oven, dried in a current of hot air (150° to 200° F.), and ground up. The oil is removed from the fish powder by extraction with ether. Starchy foods, such as oat or other flour, are now added to the fish powder, and the mixture is packed into tins for keeping.—W. P. S.

Butter, An Improved Process for Producing. J. N. Harris, London, and H. S. Headington, London. Eng. Pat. 15,564, July 15, 1898.

In this process the milk is aërated at the proper churning temperature for from 5 to 15 minutes and then churned. The butter-milk is drawn off, and cold wash-water added. Aëration is repeated and the wash-water is renewed from time to time, the temperature of the same being gradually reduced. When the wash-water is perfectly clear, the butter is worked up in the usual manner. The washing water may be preferably "brined" water.—W. P. S.

Preserving Eggs, An Improved Process and Apparatus for. H. E. Newton, London. From C. Reinhardt, Kaiserslautern, Germany. Eng. Pat. 18,130, Aug. 23, 1898.

The eggs to be preserved are placed in a vessel having a perforated plate or lid for keeping them in place. This vessel is connected at the bottom by a flexible tube with a container filled with a solution consisting of sulphuric acid (10° B.) containing 5 per cent. of a solution of ferrous salicylate (10° B.). On raising the acid container the acid flows into the egg chamber. After the action of the acid on the egg-shells has ceased, the acid is allowed to run back again into the container. The treated eggs are then washed with water and stored.—W. P. S.

Food, Cattle, Improved Manufacture of. O. Olsen, Stavanger, Norway. Eng. Pat. 18,937, Sept. 5, 1898.

The food consists of bran impregnated with herring-oil. —W. P. S.

Foodstuff for Cattle, Improved. G. Beckstroem, Mecklenburg, Germany. Eng. Pat. 21,534, Oct. 13, 1898.

The food claimed consists of dry sphagnum moss impregnated with molasses. It may be mixed with other foodstuffs (corn, rice, clover, &c.) and pressed into cakes.—W. P. S.

Preserving Fruit, Vegetable, Grain, and the like; Impts. in Methods of and Apparatus for. A. L. Lawton, Brooklyn, U.S.A., and A. W. Lawton, Brooklyn, U.S.A. Eng. Pat. 1678, Jan. 26, 1899.

The articles to be preserved are treated in a closed room with a gaseous mixture of nitrogen, hydrogen, carbonic oxide, carbonic acid gas, and chlorine.

This mixture of gases is obtained by blowing air which has passed through a solution of sodium chloride, into a charcoal furnace. The products of combustion, &c., are drawn from the top of the furnace and passed through various purifying and drying "towers" before being introduced into the preserving chamber. As the fruit and other articles give off moisture, this latter is removed by circulating the gaseous mixture through the "towers" and passing it into the chamber again. When the articles cease to give off moisture, the gaseous mixture is replaced by a second mixture consisting of nitrogen, carbonic oxide, and carbonic acid gas for from 3 to 30 days. Air is then blown into the chamber, replacing the mixture of gases. Finally, the room is again filled with a mixture of nitrogen, carbonic oxide, and carbonic acid gas, and this alternate treatment with air and the second gaseous mixture, is repeated as often as required.—W. P. S.

Milk, the Preservation of; An Improved Process for. A. Brecher, Vienna, and A. Kittel, Vienna. Eng. Pat. 9431, May 4, 1899.

From 0·1 to 0·15 per cent. of sodium bicarbonate and the same amount of sugar are added to the milk, which is then evaporated to dryness at a temperature of 40° C. The dry powder obtained, is preserved in air-tight vessels.—W. P. S.

Food from Blood, Impts. in the Manufacture of. J. W. C. Hamilton, Liverpool, and J. A. Linley, Sydney, N.S.W. Eng. Pat. 9586, May 6, 1899.

The process consists in adding 1 per cent. of salt to the blood and heating the mixture under steam pressure to a temperature of 340° F. for about five minutes. Farinaceous matters may be then added to the blood before it is used for consumption. When required to be kept, the heated blood may be sealed up in suitable containers.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

PATENTS.

Sewage of all kinds, Domestic or otherwise, including Effluents from Dyeworks, and the like; Impts. in the Treatment for the Purification of. G. D. Wild, Cleckheaton, Yorks. Eng. Pat. 14,997, July 8, 1898.

Raw sewage is collected in a tank, where it is violently agitated by blowing air into it through perforated pipes. Lime or other chemical is then added, and the mixture is again agitated. It is then run off into settling tanks, and, after subsidence of the precipitate, the clear effluent is allowed to run off.—L. A.

Sterilised Ice in Blocks or in Bottles; Impts. in Apparatus for the Preparation of; and the Sterilisation, in a Cold Condition and at the Ordinary Pressure, of Liquids generally. M. Otto, Neuilly-sur-Seine, France. Eng. Pat. 15,152, July 9, 1898.

Boxes filled with the bottles are placed upon an endless band, which travels through an aseptic chamber, in which the bottles are automatically filled with ozonised water, stoppered, and subjected to cold sufficient to freeze their contents.—L. A.

Sewage Sludge and other Substances, A Machine for the Extraction of Liquid from. C. J. Lomax, Manchester. Eng. Pat. 16,970, Aug. 6, 1898.

The sludge is forced into a perforated cylinder, which revolves against fixed ends. The liquid portion is expelled through straining cloth or gauze, with which the inside of the cylinder is lined, and the solids are taken out by means of a screw conveyor working on a shaft at the bottom of the cylinder.—L. A.

(*C.*)—DISINFECTANTS.

PATENTS.

Cleaning and Disinfecting Textile Goods, Wearing Apparel, and Similar Articles; Impts. in. E. F. Kur, Manchester (partly from M. Boehler, Frankfort a/Main, Germany). Eng. Pat. 14,202, June 27, 1898.

The articles are simultaneously cleaned and disinfected by treating them with a volatile solvent, such as naphtha, benzine, carbon tetrachloride, or the like, mixed with soluble disinfectants, such as phenol or its homologues, mercurial soaps, formaldehyde, or the like.—L. A.

Sulphur Candles and their Containing Vessels, Impts. in. J. L. Wade, London. Eng. Pat. 18,511, Aug. 29, 1898.

The candles are encased with asbestos or other porous material, which soaks up water from a dish in which the candle is placed. The moisture evaporated by the heat of the burning candle hydrates the sulphur dioxide formed by the combustion. To facilitate lighting, corrugated cotton wicks impregnated with potassium chlorate or nitrate are embedded in the sulphur forming the candle.—L. A.

Disinfectants and Antiseptics, Impts. in. A. Planner, London. Eng. Pat. 26,983, Dec. 21, 1898.

For the production of slowly soluble disinfectant tablets for immersion in the water of flushing cisterns, potassium permanganate or other soluble disinfectant is moulded into blocks with naphthalene or other solid, easibly fusible hydrocarbon.—L. A.

Formic Aldehyde for Disinfecting Purposes, Impts. in Apparatus for the Generation of Gaseous. L. Roberge. Anvers-sur-Oise, France. Eng. Pat. 7726, April 12, 1899.

The apparatus consists of a steam generator of annular shape, furnished with pressure gauge and safety valve. The central space contains the formic aldehyde generator, which is a cylindrical, egg-ended copper vessel, surrounded by a coiled pipe which enters the vessel at the lower end. Just above the inlet a perforated copper dish is fixed, on which trioxymethylene is placed. The exit pipe is at the top, and contains a small steam ejector. A thermometer, contained in a tube passing through the top of the generator, registers the temperature. By the action of the injector, air, drawn through the heated coil, passes up through the trioxymethylene, and the mixture of air and formaline vapour, saturated with steam from the injector, is forced through the exit tube into the apartment to be disinfected.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

PATENT.

Cardboard, Paper, and Wood Pulp, and other Substances of a Fibrous or Porous Nature, and of Articles made therefrom; Impts. in the Treatment of. **J. F. Bennett and W. Appleyard, Sheffield. Eng. Pat. 9716, May 9, 1899.**

The inventors claim the process of treating the above materials, and articles made from such, by immersing them in a bath of molten sulphur. Also, if greater hardness be required, the treated material may be subsequently submitted to pressure by rolling or other means. The product claimed is rendered hard and impervious by the above treatment, and capable of taking a high polish.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Iodine, Action of, on Alkalis. E. Péchard. Comptes Rend. **128**, [24], 1453—1456.

A solution of iodine in caustic alkali is always yellow, even in presence of considerable excess of alkali. The iodine reacts with the alkali so as to form both iodate and hypoiodite, with the corresponding amounts of iodide; but the hypoiodite tends to react in the inverse direction with the iodide, re-forming alkali and iodine. It is the free iodine resulting from this tendency which gives the yellow colour to the liquid. The author has determined the quantities of hypoiodite, iodate, and free iodine present under different conditions. With increasing proportions of sodium hydrate, the amount of free iodine diminishes; with two molecules of hydroxide to one atom of total iodine, the liquid contains 2 per cent. of the total iodine as free iodine—a proportion which varies imperceptibly with more soda. In the same liquid, the weight of iodate formed, reaches a maximum, corresponding to 92 per cent. of the total conversion expressed in the equation—

$$I + NaOH = \tfrac{1}{6} IO_3Na + \tfrac{5}{6} NaI + \tfrac{1}{2} H_2O$$

The hypoiodite slowly increases with increase of soda. With the mixture I + NaOH, increase of temperature from 0° to 80° C. makes practically no change in the amount of free iodine, though the hypoiodite is transformed rapidly into iodate as the temperature rises. The same change takes place in the cold, but with extreme slowness.—J. T. D.

Mercuric Iodide: The Nature of its Vapour. D. Gernez. Comptes Rend. **128**, [25], 1516—1519.

The red and the yellow varieties of mercuric iodide were allowed to evaporate in a vacuum at various temperatures, and the vapours condensed on a cool surface, also kept at various temperatures below the temperatures of evaporation. In all cases, when the cooling surface was quite clean, the yellow variety was deposited; but when different parts of the cooling surface were rubbed, before the operation, with one or the other variety of the iodide, that variety was always deposited.—J. T. D.

Mercurous Iodide, The Action of Potassium Iodide on. M. François. J. Pharm. Chim. 1899, **10**, [1], 16—18.

At a temperature of 20° C., mercurous iodide is completely decomposed by an excess of a solution of potassium iodide, metallic mercury being left. If, however, a solution of potassium iodide be saturated with mercuric iodide, and metallic mercury be added to the mixture, mercurous iodide is formed. A state of equilibrium will have been established for the above temperature, when the solution contains 11·90 per cent. by weight of mercuric iodide.
—W. P. S.

Ammonio-Mercuric and Potassio-Mercuric Iodides, Action of Water on. M. François. Comptes Rend. **128**, [24], 1456—1458.

The salt $HgI_2NH_4I, 2H_2O$ is decomposed by water, with precipitation of mercuric iodide. The supernatant liquid, however, is not a solution of $HgI_2 2NH_4I$, but simply a solution of mercuric iodide in ammonium iodide, for its content in mercuric iodide varies continuously with the temperature. Precisely the same is the case with the corresponding potassium salt.—J. T. D.

Chloroform Anæsthetic, Rectification and Preservation of. V. Masson. J. Pharm. Chim. 1899, **9**, [12], 568.

The method for the rectification of commercial chloroform, at present official in the *Codex*, is somewhat modified, as follows:—Crude commercial chloroform is first washed with water, the aqueous layer separated, and the chloroform shaken with 2·5 per cent. of its weight of sulphuric acid, and the operation being repeated with a fresh portion of acid, if necessary, the acid being left in contact with the chloroform for two or three days. The latter is then treated with 3 per cent. of its weight of caustic soda solution, sp. gr. 1·33, which is left in contact also for two or three days. It is then washed with water, dried over calcium chloride, and 2½ per cent. of poppy-seed oil added.

Distillation is then conducted into graduated receivers containing 0·2 per cent. by weight of alcohol for the amount of the chloroform they are to contain. The important modifications in this process are, the prolonged contact of the chloroform with the soda solution; the final distillation over poppy-seed oil (it is at present employed in the official process for a preliminary distillation); and the presence of the trace of alcohol in the receiver. Poppy-seed oil is found to exert a marked preservative action on chloroform, a specimen containing 0·1 per cent. having been exposed to direct sunlight for 21 days without undergoing decomposition, and one with 0·2 per cent. of the oil, kept in ordinary light, showed no decomposition in three years. The preservative effect of alcohol on chloroform is demonstrated by the condition of samples at the *Pharmacie Centrale*, where specimens containing only 0·1 per cent., exposed in yellow glass bottles in a window to diffused light, have kept perfectly for 10 years. In storing chloroform, corked bottles should not be employed; it should always be preserved in stoppered bottles, which should, however, be luted over with bichromate gelatin to prevent leakage. This gelatin is thus composed: Solution A.—Gelatin, 100; distilled water, 300; glycerin, 10. Solution B.—Potassium bichromate, 20; distilled water, 200. Two parts by weight of the first are mixed with one part by weight of the second, both previously being made warm. The mixture is to be kept at 55°—60° C. on the water-bath during use.—J. O. B.

Phenols, Chlorocarbonates of. E. Barral and A. Morel. Comptes Rend. **128**, [26], 1578—1581.

Whilst the chlorocarbonates of the alkyl radicles are easily prepared, those derived from the phenols have hitherto been little examined, chiefly because of their tendency to break up into carbonyl chloride and phenolic carbonate. The authors have succeeded in preparing them in a pure state by adding to a 20 per cent. toluene solution of carbonyl chloride (1 mol.) a 5 per cent. aqueous solution of phenol (1 mol.) and sodium hydroxide (1 mol.). The solution of the phenol is added in small quantities at a time, and the liquids well shaken after each addition, more of the phenol solution being added only after the former portion has completely cleared. The toluene solution is separated, dried, and the toluene distilled off under diminished pressure. The residue, fractionated in a vacuum of 25 mm. of mercury, yields a liquid distillate passing over at 100°—120° C., according to the phenol used, and a small amount of solid passing over about 200° C. The latter is the carbonate corresponding to the phenol employed; the former, after a second rectification, yields the pure chlorocarbonate. The temperature must not be allowed to rise during the reaction of the phenol on the carbonyl chloride, nor must it sink as low as 0° C., or the reaction does not take place. The authors have thus prepared the derivatives of phenol, ortho- and paracresol, guaiacol, thymol, tribromophenol, and pentachlorophenol.—J. T. D.

Tartaric Acid, New Commercial Method for the Manufacture of. G. Scarlata. Monit. Scient. 1899, **13**, 360—361.

The raw materials for the manufacture of tartaric acid consist of the acid tartrate of potassium and the normal calcium tartrate which are present in the raw tartar from casks, in wine lees, and in grape skins. The manufacture is almost entirely carried on in England, the United States, and Germany, the wine-producing countries possessing only a few factories of little importance. It is stated that there has been no improvement made on the old method of Scheele, which is still used in most of the factories. In this process, the first step is to obtain calcium tartrate, which can be done by different methods, but they all require a considerable amount of time and fuel, as also does the second part of the process, which consists in decomposing the calcium tartrate with sulphuric acid. The method yields no useful by-product, and does not admit of the recovery of any of the materials first used.

The author proposes a method based on the decomposition of the crude tartrates by fluosilicic acid, in which the tartaric acid is prepared directly from the raw material, whilst the reagents used may be recovered. The crude tartrates are decomposed by fluosilicic acid according to the following equations:—

$$2C_4H_5O_6K + H_2SiF_6 = 2C_4H_6O_6 + K_2SiF_6.$$
$$C_4H_4O_6Ca + H_2SiF_6 = C_4H_6O_6 + CaSiF_6.$$

Tartaric acid and calcium fluosilicate are both soluble and remain in the clear solution, but the potassium fluosilicate is to a great extent precipitated, its solubility being only 1 in 825. The small quantity of potassium fluosilicate remaining dissolved, is precipitated very rapidly by evaporating the solution. The amount of calcium fluosilicate is determined in a portion of the solution, and then rather more than the calculated quantity of sulphuric acid added; the slight excess of sulphuric acid exerts a favourable influence on the crystallisation of the tartaric acid. The solution is concentrated to accelerate the deposition of the calcium sulphate, the organic matter, and the last traces of potassium fluosilicate; then the clear liquid is decanted off and allowed to crystallise.

The principal by-product is thus potassium fluosilicate, which is found mixed with silica, and from which the fluosilicic acid may be recovered by treatment with sulphuric acid, according to the following equations:—

$$K_2SiF_6 + H_2SO_4 = SiF_4 + 2HF + K_2SO_4.$$
$$4HF + SiO_2 = SiF_4 + 2H_2O.$$
$$3SiF_4 + 4H_2O = 2H_2SiF_6 + Si(OH)_4.$$

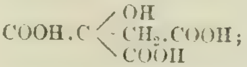
The author proceeded as follows, using a crude tartar containing total tartaric acid, 62·56 per cent.; tartrate of potassium, 67·16 per cent. and tartrate of calcium, 11·25 per cent. 10 kilos. of the well broken up material were treated in a wooden vat furnished with a stirrer, with 58 kilos. of a 60 per cent. solution of fluosilicic acid. The mixture was agitated for an hour, transferred to a filter-press, and the clear solution led into a wooden vat lined with lead and heated by a steam coil. The evaporation was continued until potassium fluosilicate commenced to be deposited. After standing several hours, the clear liquid was decanted into a vat furnished with a stirrer. The lime was determined in a portion of the solution by adding an excess of ammonium oxalate, and titrating the excess of oxalic acid with permanganate. The total quantity of solution contained 209 grms. of lime. The solution was therefore treated with the calculated quantity of sulphuric acid—512 grms. of H_2SO_4 diluted to 1 litre, and the mixture transferred to the filter-press. The deep reddish-brown solution of tartaric acid thus obtained was decolorised by animal charcoal, then evaporated and crystallised, care being taken to remove the calcium sulphate, which is again precipitated at the commencement of the evaporation. The crystals of tartaric acid obtained, when compared with a sample of chemically pure tartaric acid, showed a purity of 98·57 per cent.

Recovery of the Fluosilicic Acid.—The potassium fluosilicate obtained as by-product, is treated with the calculated quantity of concentrated sulphuric acid in a cast-iron pot fitted with a mechanical stirrer, the cover is luted on, and the mixture heated, with continual agitation. The cover is provided with two tubes: the first, which is for passing a current of air through at the end of the operation, is kept closed by means of a tap during the first part of the process; the second, which is much larger, is for the purpose of passing the silicon fluoride into a vessel filled with water. In this vessel the amount of water present may be varied according to the strength of the solution of fluosilicic acid desired.

The potassium sulphate obtained, when mixed with the residues from the original process, is stated to form an excellent manure.—A. S.

Citric Acid, A Lower Homologue of. A. Durand. Comptes Rend. **128**, [25], 1525—1527.

Haller and Held's synthesis of citric acid has been applied by the author to oxalacetic acid, COOH.CO.CH$_2$.COOH, the ethyl derivative of which, treated with hydrocyanic acid, yields a cyanhydrin, which in its turn yields by hydrolysis an acid having the constitution—



$$COOH.C\begin{cases}OH\\CH_2.COOH;\\COOH\end{cases}$$

Citric acid is the methyl derivative of this acid. The calcium and zinc salts of the acid have been prepared, and the author is now endeavouring to prepare related acids from methyloxalacetic, mesoxalic, and other ketonic acids.—J. T. D.

Camphopyrazolones [Campho-Antipyrins]. H. Wahl. Ber. 1899, **32**, [12], 1987—1991.

By heating camphocarboxylic ester with phenylhydrazine at 140° C., adding a little alcohol and then hydrochloric acid, filtering, dissolving in caustic potash, filtering, and precipitating with acetic acid, 1-phenyl-4.5 campho-3-pyrazolone is obtained. This substance crystallises in thick needles, melting at 285° C. with partial decomposition, and is soluble with difficulty in ordinary solvents; it cannot be directly methylated. The 2-methyl derivative (campho-iso-antipyrin) is obtained by warming the benzoyl compound with excess of methyl iodide, and decomposing the product with dilute caustic soda. Campho-iso-antipyrin crystallises in tables melting at 182°—183° C.; like iso-antipyrin, it is poisonous.

1-phenyl-3.4-campho-5-pyrazolone is formed on condensing camphocarboxylic ester with phenylhydrazine by means of phosphorus trichloride in toluene solution; it crystallises in small needles uniting to warts, and melts at 152° C. The 2-methyl derivative, campho-antipyrin, may be obtained in a similar manner to campho-iso-antipyrin; it crystallises in white, shining prisms, which melt at 193° C. In physiological properties it is completely analogous to antipyrin.—A. C. W.

Narcotine and Narceïne. G. B. Frankforter and F. H. Keller. Amer. Chem. J., 1899, **22,** [1], 61—67.

The following method for the conversion of narcotine into narceïne gives good results:—Narcotine is digested with excess of methyl iodide for 10 hours, excess of the latter reagent removed on the water-bath, and the alcoholic solution of the residue treated with chlorine water. A light yellow precipitate is at first formed, which soon dissolves; with excess of chlorine the precipitate is darker, and after standing a few hours becomes crystalline. The filtrate gives on evaporation a brownish gum, which soon becomes crystalline; this is pure narcotine methyl chloride. Narceïne is obtained in almost quantitative yield from this chloride by neutralising with caustic soda and passing a current of steam. The brown substance which separates on the addition of chlorine water, melts at 149° C. After recrystallisation, it was found to be narcotine methyl tri-iodide, $C_{22}H_{27}I_2NO_7.CH_3I$. Chlorine water reacts with this substance in the same manner as hydrochloric acid does with narcotine, removing two methoxyl groups from the opianic acid radical, and leaving the third, in the isoquinoline group, unchanged.—A. C. W.

Hederine from Ivy. Houdas. Comptes Rend. **128,** [24], 1463—1465.

Hederine crystallises from alcohol in fine needles radiating from centres. The crystals at 130° C. lose 25 per cent. of their weight; long-continued exposure to this temperature decomposes them. At 248° C. they melt to a faintly amber-coloured liquid, with evolution of gas. Hederine is practically insoluble in water, chloroform, petroleum spirit, ether, or benzene; it dissolves in 805 parts of cold and 333 parts of boiling acetone, and is much more readily soluble in alcohol. It dissolves easily when warmed with solutions of caustic alkalis or alkali carbonates. It is dextrorotatory ($\alpha_D = 16^\circ \cdot 27$). Its formula appears to be $C_{64}H_{104}O_{19}$, and its molecular weight, determined by boiling-point method, agrees with this. Dilute sulphuric acid decomposes the glucoside into a dextro-rotatory sugar, $C_6H_{12}O_6$ ($\alpha_D = 102^\circ \cdot 66$), which the author is investigating, rhamnose, and *hederidine*, $C_{26}H_{40}O_4$, which forms brilliant rhombic prisms soluble in alcohol, which melt at 324° C., and can be sublimed without decomposition.—J. T. D.

Ipecacuanha, Johore. J. C. Umney and R. S. Swinton. Pharm. J. 1899, **63,** [1518], 89. Read before the British Pharm. Conference.

It is almost certain that the root of the Johore ipecacuanha is derived from *Psyschotria Ipecacuanha*, the species which yields Rio or Brazilian root. Microscopic examination of the powder showed no difference to that of the powder obtained from Rio root. The percentage of total alkaloids was found to be 1·7, and the proportions of the alkaloids were found, as the mean of three experiments, to be: emetine, 72·94; cephaeline, 22·94; a third alkaloid or other alkaloids, 4·12. There thus appears to be a larger proportion of alkaloid, other than emetine and cephaeline, than is the case with Rio root, and a lower proportion of total alkaloid than with average Brazilian root unmixed with stem. The extractive yielded by the Johore root was not so great as that yielded by the Brazilian; and the precipitate with basic lead acetate in the extractive freed from alcohol was also very much less.

The authors state that, so far as their observations go, there appears to be no reason why the Johore root should not be used for standard preparations of ipecacuanha.

—A. S.

The Limonal [Citral] of the Essential Oil of Lippia Citriodora. P. Barbier. Bull. Soc. Chim. 1899, **21,** [13], 635—638.

The essential oil of the leaves of *lippia citriodora* gives, on fractionation *in vacuo*, 67—70 per cent. boiling between 106°—108° C., under 10 mm. pressure. This liquid is inactive, has the same composition as limonal (citral), and gives the same products on oxidation and decomposition by potassium carbonate. On treatment with hydroxylamine, an oxime boiling at 119°—120° C. under 10 mm., is obtained as the principal product, accompanied by small quantities of an isomeric oxime boiling at 143°—145° C. under the same pressure. The latter is identical with citraldoxime. Under the same conditions limonal from *lippia* gives the lower boiling oxime; limonal from lemon-grass oil, the higher boiling oxime. The isomerism cannot therefore be due to nitrogen.

Sodium bisulphite reacts with the *lippia* limonal in the same manner as with the lemon-grass aldehyde: a crystalline product is first formed, quickly dissolving with a spontaneous rise of temperature. From the solution, caustic soda separates an aldehyde which gives exclusively the higher boiling oxime. This latter may also be obtained directly from the lower boiling oxime by the action of hydrochloric acid gas on its ethereal solution. The transformation is only partial.

The oxime boiling at 119°—120° C., on boiling with acetic anhydride, forms a small quantity of limonic nitrile, but is chiefly converted into an oil distilling at a high temperature and without a fixed boiling point. Under the same conditions, the oxime boiling at 143°—145° C., gives an excellent yield of the nitrile. The *lippia* limonal, treated in alcoholic solution with semicarbazide hydrochloride and a slight excess of sodium carbonate, gives chiefly the semicarbazone melting at 171° C. From limonal obtained from lemon-grass oil by simple fractionation, and from the limonal of *lippia* regenerated from its bisulphite compound, the semicarbazone melting at 135° C. is the chief product.

The author concludes that his results, combined with those of Bouveault (this Journal, 1899, 704), put the existence of two isomeric limonals beyond doubt; he inclines to the opinion that the isomerism is stereochemical.

—A. C. W.

Morphine, Decomposition Products of, free from Nitrogen. E. Vongerichten. Ber. **32,** [9], 1521.

See under IV., *page* 751.

Cocaine, The Chromic Acid Test for. G. L. Schaefer. Pharm. J. 1899, **63,** [1517], 66.

See under XXIII., *page* 790.

Cocaine Test, The McLagan. C. Boehringer und Soehne. Chem. and Druggist, 1899, **55,** [1015], 59.

See under XXIII., *page* 789.

PATENTS.

"*Saligenin,*" *The Manufacture of a New Preparation from.* L. Sell, Munich, Germany. Eng. Pat. 13,714, June 20, 1898.

The claims are for a new preparation from saligenin, and its method of manufacture, which consists in heating salicin (or saligenin) with such tanning materials as give no gallic acid on treatment with mineral acids, in 5 per cent. mineral acid solution at 90° C. until free tanning principle or free tannic acid can no longer be detected in the solution.

—A. C. W.

Quinine and other Cinchona Alkaloids, The Manufacture and Production of Carbonic Ethers of. G. W. Johnson, London. From Vereinigte Chininfabriken Zimmer and Co., Frankfort-on-Main, Germany. Eng. Pat. 16,564, July 29, 1898.

The manufacture of the carbonic esters of quinine is claimed, by a process which consists in acting on the alkaloid (4 mols.) with phosgene gas (1 mol.).—A. C. W.

Ozonometer; An Improved Specific Gravity Estimating Apparatus for Gases, especially applicable as an. M. Otto, Neuilly-sur-Seine, France. Eng. Pat. 17,525, Aug. 13, 1898.

See under I., *page* 737.

Fluoroform, Impts. in the Production of. F. Valentiner, Leipzig-Plagwitz, Germany. Eng. Pat. 7244, April 6, 1899.

The method claimed consists in heating a mixture of silver fluoride and iodoform with sand or other inert substance. The reaction commences at 40° C., and proceeds gradually. The gas may be purified by washing with alcohol and then cuprous chloride, and collected over water. The presence of water is said to facilitate the reaction.—A. C. W.

o-Chlorophenol, A New or Improved Preparation of. J. O. O'Brien, Manchester. From M. Hazard-Flamand, Boulogne, France. Eng. Pat. 7704, April 12, 1899.

Phenol is sulphonated at 100°—110° C. *in vacuo*; the use of a vacuum is claimed. The resulting *p*-phenolsulphonic acid is chlorinated by adding hydrochloric acid and then potassium chlorate in small quantities, the temperature being kept at 50° C. This process, together with the decomposition of the chlorosulphonic acid by heating at 200° C., forms the first claim.—A. C. W.

Benzoic Acid from Coal-Tar Oil, Process for the Production of. The Aktiengesellschaft für Theer und Erdöl Industrie and G. Kraemer, Berlin, Germany. Eng. Pat. 7867, April 19, 1899.

The carbolic or creosote oil fraction obtained from coal tar, and boiling between 160° and 240° C., or within narrower limits, contains benzonitrile, which on hydrolysis gives a pure benzoic acid. The fraction from which phenol is obtained is washed with dilute soda lye (sp. gr. 1·1), which removes phenol and cresol. The remaining oil is placed in a jacketed vessel provided with an agitator, and connected with a condenser and receiver. Caustic soda lye (sp. gr. 1·4) is then added in about twice the quantity corresponding to the benzonitrile present. The mixture is agitated and wet steam passed in for some hours, as long as ammonia is evolved in considerable quantity. The receiver then contains the lower boiling constituents of the oil, together with a somewhat concentrated ammonia solution, whilst the contents of the still consist of a lower alkaline layer and an upper oily one. The former is neutralised with carbonic acid or a mineral acid, separated from traces of phenol and resinous matters, and the resulting solution of sodium benzoate is decomposed hot by adding an excess of acid. On cooling, pure benzoic acid separates in white crystals.—T. A. L.

Curative and Immunising Preparations [Enzymes], Impts. in. O. Loew, Garret Park, Maryland, U.S.A. Eng. Pat. 9142, May 1, 1899.

The cultures of a non-virulent variety of *bacillus pyocyaneus* developed for several weeks at 30°—36° C., are filtered hrough Berkfeldt or Chamberland filters, neutralised exactly, evaporated *in vacuo* at 22°—30° C. to one-tenth, and dialysed. The products of metabolism, nourishing salts, and organic matters are thus removed. The enzyme is then combined with animal proteids by means of caustic potash, o render the preparation durable. The process is claimed substantially as described. The product may be employed for curing and immunising against anthrax and diphtheria. —A. C. W.

Quinine and Caffeine, Soluble Preparation from. A. Kreidmann. Amer. Pat. 625,886, May 30, 1899. Chem. Zeit. 1899, **23**, 526.

A mixture of hydrochloride of quinine and caffeine, prepared by crystallising.—S. K.

XXI.—PHOTOGRAPHY.

Latent Image, Silver Sub-Bromide, and the Silver-Germ Theory of the. J. M. Eder. Phot. Corr. 1899, **36**, 276 and 332; through Chem. Zeit. Rep. 1899, 196.

One of the chief arguments employed by Abegg (this Journal, 1899, 516) to support the "silver-germ theory" especting the composition of an exposed bromide plate before development, is based on the statement that nitric cid dissolves (*i.e.* destroys) the latent image, which should ot be the case were the altered material in the film a subromide of silver. This, however, is not correct: nitric acid does not behave in the manner indicated; and recent experiments only strengthen the present author in his opinion that the primary effect of light is to liberate bromine and produce a sub-haloid. During development, contact of the metallic silver with some of the unchanged bromide sets up an insignificant secondary action; but the extent of this action has been over-estimated by the upholders of the germ theory. Neither the germ theory nor the hypothesis that exposure to sunlight determines a purely molecular change in the bromide is sufficient to explain the following experiments:—A collodio-bromide plate was exposed in the camera, soaked in a 1 per cent. solution of potassium bromide for 7 mins., and then developed with alkaline "glycin." It gave a strong negative, for the bromide had not attacked the latent image. In another case, bromine water was added to the potassium bromide till the liquid was distinctly yellow, and a plate was treated therewith exactly as before. No image was formed on development, because the free bromine thus introduced had made good the loss of halogen during exposure, converting the sub-bromide of the latent picture once more into the normal salt.—F. H. L.

PATENTS.

Photographic Pictures, Improved [Rapid] Method of Producing [from Unfixed Negatives]. A. J. Boult, London. From E. Goldschmidt, Charlottenburg, Berlin. Eng. Pat. 16,959, Aug. 5, 1898.

The object of this specification is to lessen the time occupied in producing finished positive prints by avoiding the usual operations of fixing, washing, and drying the negative, thus bringing the whole process, as regards rapidity, in line with the older methods of preparing a direct positive by development, while it yet yields any desired number of copies. The plate is exposed and treated with a strong developer till the details are all visible but "density" is still lacking; it is then washed, and a sheet of rapid positive paper (damped, if so preferred) is rubbed on to it, face to face; exposure to artificial light is given, and the ordinary routine proceeded with. The unremoved bromide in the film compensates for the want of density, and acts similarly to the screen, often put before a weak negative to give increased contrasts in the print. The process is apt to leave traces of developer behind in the gelatin, and if many prints are required, the negative may become veiled thereby, spoiling the latter copies; this can be overcome by bathing it in a solution of potassium bromide and then washing as before. The presence of the bromide in the wet negative also makes for greater contrasts in the positive picture.—F. H. L.

Cellulose Films for Photographic and other Purposes, Impts. in the Method and Means for Producing. J. C. Chorley, Warrington. Eng. Pat. 18,697, Sept. 1, 1898.

See under V., *page* 756.

XXII.—EXPLOSIVES, MATCHES, Etc.

Report, Annual, (Twenty-third) of H.M. Inspectors of Explosives for 1898.

This report records the death, during the year, of the late Chief Inspector, Sir Vivian Dering Majendie, K.C.B., and a high tribute is paid to his ability and energy.

The vacancy in the Department has been filled by the appointment of Captain M. B. Lloyd, R.A., as one of Her Majesty's Inspectors of Explosives, and this officer is now in charge of the Testing Station in connection with the use of explosives in coal mines.

Seven new factories have been licensed, of which no less than three are for picric acid.

Only two deaths occurred from accident during manufacture, the average number for the last 10 years being 4·8.

There is still a large amount of foreign nitroglycerin compounds imported—983,600 lb., as against 1,153,550 lb. in the previous year. Gelatin dynamite heads the list; the amount of carbonite, which two years ago was highest of all these compounds, has now fallen considerably.

Dr. Dupré reports an increased activity among inventors, 26 new explosives having been submitted for examination, of which 21 successfully passed the tests, among the successful being one containing ammonium perchlorate.

The number of accidents during manufacture was 47, resulting in the death of two persons. Two slight explosions occurred at Waltham Abbey during the grinding of picric acid, due, it is thought, to the bearing too heavily of the brass scrapers on the bed of the mill.

Experiments made with acetylene mixed with oil-gas under compression, showed that when the proportion of acetylene does not exceed 20 per cent., and the compression is not more than 150 lb. to the square inch, the mixture is not explosive.

Dr. Dupré gives a very interesting review of the progress which has been made during the last 25 years, the period during which he has been officially connected with the Explosives Department of the Home Office. "In 1873 the only explosives licensed for manufacture and importation, other than gunpowder, were dynamite and a few preparations of nitrocellulose. One chlorate mixture—Horsley's powder—had indeed been licensed, but fortunately it has never come into use. In 1898 not less than 81 explosives of classes 1 to 4 were on the authorised list, while 19 others had passed the necessary tests and had become licensable, and 13 others had been in this list, but for which no license is at present in force."

It is pointed out, however, that this large increase in the number of explosives does not indicate a corresponding increase in the number of materials employed. Nitroglycerin and nitrocellulose, the only explosives of the kind in use in 1873 are still the main ingredients of the bulk of the explosives in 1898. Great progress, however, has been made in the knowledge of the manufacture of these explosives. "In 1873 nitrocellulose was divided practically into two kinds only, so-called insoluble nitrocellulose or gun cotton, and soluble nitrocellulose or collodion cotton," the solvent implied, being a mixture of ether and alcohol. Now we know that solubility in ether-alcohol is not, as was supposed, a function of the degree of nitration, but solely one of method of manufacture. Nitrocellulose of very varying degrees of nitration, up to tri-nitrocellulose, can now be manufactured soluble in the above mixture. The most remarkable and far reaching advance in the use of gun-cotton and nitroglycerin, an advance based in a measure on the discovery of blasting gelatin by Alfred Nobel, is the recognition of the fact that by converting these two materials into more or less hard homogenous nonporous solids they almost completely lose their character of detonating agents, and may be used as most effective propellants. The rate of combustion of these gelatinised explosives is under very perfect control, inasmuch as they burn only on their surfaces, by varying the relation between weight of explosive and surface exposed. Almost all our smokeless powders which have added so much to the power and utility of our guns, are based on this discovery.

The next most important, or perhaps equally important advance, which we owe mainly to Dr. Sprengel, is the substitution of ammonium nitrate for saltpetre in many explosives. The great value of this compound lies partly in the fact that it leaves no solid residue on combustion, partly that it greatly reduces the temperature of explosion of all explosives in which it is employed. The latter fact, chiefly renders it so valuable an ingredient in the so-called safety explosives. A great drawback to its use, however, is its property of rapidly absorbing moisture from ordinary atmospheric air, which renders a perfectly waterproof wrapper or case absolutely necessary. "Concurrently with the introduction of ammonium nitrate came the use of various nitro derivatives of the so-called aromatic compounds, which, though usually not of a composition to serve as explosives by themselves, yield very powerful explosives in admixture with ammonium nitrate. The only compound of this class which is at present largely used as an explosive by itself is trinitrophenol or picric acid. Picric acid, now known as one of our most powerful detonating explosives, was manufactured for many years, and in considerable quantities, as a yellow dyestuff, without a suspicion of, and with utter disregard to its highly explosive character. It furnishes an extremely striking and valuable illustration of the danger involved in proclaiming an explosive to be perfectly safe on the strength of its having been manufactured and used for some years without accident." True nitro compounds, like picric acid, nitronaphthalene, and dinitrobenzele, have the great advantage over compounds like nitroglycerin and gun-cotton, which are really nitric ethers, in not being liable, like these, to spontaneous explosion when even slightly impure and in remaining unaffected by the presence of even relatively large quantities of acid. "Many attempts have been made in the course of the 25 years to make use of the powerfully oxidising character of potassium chlorate in the production of an explosive, but so far without success. There is, however, some reason to hope that this difficulty will soon be overcome."

In regard to the testing station for testing explosives for use in coal mines at Woolwich, Major Cooper-Key reports that the apparatus works well and that no necessity for altering the conditions of the test has arisen. The chief object in view is to ensure uniformity of conditions for the test, rather than to endeavour to more closely produce the conditions obtaining in coal mines, for the latter cannot be so uniformly reproduced.

These considerations have led to the rejection of coal dust in the experiments, as it is found to be impracticable to ensure uniformity in successive mixtures of dust and air or gas, and now the explosives which are being tested with a view to their being placed on the "Permitted List," are only fired into an explosive mixture of air and coal-gas.

—W. M.

Potassium Chlorate, Explosibility of. C. A. Lobry de Bruyn. Zeits. für angew. Chem. 1899, [27], 633.

The author's attention has been attracted by the recent destruction of a chemical works at St. Helens. In this case a quantity of 156 tons of potassium chlorate, lying in store, unmixed with any organic substance exploded.

For a substance to be capable of explosion, it must decompose exothermally with the evolution of gas. Potassium chlorate satisfies these conditions, since Berthelot determined that the decomposition $KClO_3 = KCl + O_3$ liberates 11,000 calories.

In 1891, in the course of some investigations on "bellite" (4 parts ammonium nitrate to 1 part dinitro-benzene), the author demonstrated (Recueil des trav. chim. Pays-Bas 1891, **10**, 127) that, whilst "bellite" could be exploded by an ordinary detonator containing 1 grm. of fulminate, pure ammonium nitrate requires a more powerful detonator, of 3 grms. of fulminate or 10—20 grms. of "bellite," in order to act as a powerful explosive by itself. Different explosives require different degrees of initial detonation, and it was suggested, *loc. cit.*, that other endothermic compounds, which decompose with evolution of gas, as for instance, nitric acid or potassium chlorate, might be caused to explode, provided a sufficiently powerful detonator were used. The disaster at St. Helens seems to the author to be analogous to a local fire in a store of gun-cotton. The fire commences quietly, and the cotton simply decomposes and burns, but later on, as the fire spreads and becomes more fierce, the point is reached at which the gases produced can no longer escape into the air with sufficient rapidity, but are forced out with explosive violence; this primary explosion acts as a detonator to the hitherto unaffected bulk, and the whole of the gun-cotton in the store explodes. True, potassium chlorate would require a far more powerful detonator than gun-cotton, and it is not itself combustible, but it is quite probable that a portion of the salt was decomposed by a fire in the vicinity of the store, and that the increasing evolution of gas under the action of the heat, or contact of the chlorate with burning wood, was sufficient to give the initial detonating explosion to the whole mass (see this Journal, 1899, 436).—J. F. B.

Ammonium Perchlorate, Preparation of, from Sodium Perchlorate and Ammonium Nitrate. U. Alvisi. Zeits. angew. Chem. 1899 [23], 551.

See under VII., *page* 759.

PATENTS.

Matches, Impts. in the Manufacture of. Bohy, Gallay, and Co., Noyon, Switzerland. Eng. Pat. 16,037, July 22, 1898.

The use of calcium hypophosphite is claimed in match pastes, and for a match made from a paste of the following composition:—25 grms. of turpentine, 1006 of potassium chlorate, 200 of sulphur, 150—200 of calcium hypophosphite, 5—10 of bichromate of potassium, 125—150 of barium chromate, 200—250 of powdered glass, and 10 of colouring material. The ingredients are mixed with a solution of 212·5 grms. of glue, and 30 of gum tragacanth in 650 of water. The gum and glue are dissolved by steeping in water for 12 hours and then heating on the water-bath to 90° C. The paste is milled several times and when used for dipping, is kept at 40° C.—E. W. W.

Gunpowder, Impts. in the Manufacture of. C. W. Curtis, London, and A. H. Durnford, Hounslow. Eng. Pat. 17,878, Aug. 19, 1898.

By this invention a gunpowder is produced which can be used with safety in dusty and fiery mines, the flame and incandescent particles produced on explosion being fewer, and much lower in temperature than in the case of ordinary gunpowder. This powder is made by using a charcoal containing a large amount of volatile matter mixed with potassium nitrate. Charcoal containing about 60 per cent. of carbon is mixed with four times its weight of potassium nitrate, or charcoals containing different amounts of carbon may be used, the quantity of potassium nitrate being adjusted so as to be sufficient to convert all the carbon into carbonic anhydride, but the percentage of carbon in the charcoal should not be greater than 70 or less than 50. The charcoal is prepared by heating wood or other suitable material, preferably alder or willow wood in iron cylinders at a low temperature so that a large amount of volatile matter may be retained. A charcoal containing about 65 per cent. of carbon gives off about 50 of volatile matter when heated to redness in a current of coal gas, whilst a charcoal containing 58 per cent. of carbon "will evolve about 63 of volatile matter."

The potassium nitrate and charcoal are ground fine and mixed together and are then incorporated and granulated in the same way as ordinary gunpowder.—E. W. W.

Explosive Compound, An Improved Smokeless and Waterproof. C. F. Hengst, Plumstead. Eng. Pat. 18,002, Aug. 22, 1898.

Unbleached esparto fibre, reduced to a woolly or fluffy consistency by means of a disintegrator, is immersed in a bath prepared by mixing 2 parts of sulphuric acid of sp. gr. 1·85 at 18° C. with 1 of nitric acid of sp. gr. 1·42—1·50 at 18° C., and allowing the mixture to cool. Sufficient fibre to form a pulp is added and allowed to macerate from 5—24 hours, according to conditions of usage, temperature, &c. After pressing, the acid is washed out with water, or preferably by stirring in a boiling solution containing 3 oz. of potassium bicarbonate in 6 galls. of water, for 6—8 hours.

Before boiling, the pulp, which is now of an explosive character, may be treated with a solution containing 4 oz. of potassium permanganate in 10 galls. of water, and then coloured dark brown by treating with triamidoazobenzene hydrochloride. The liquid is removed by means of a hydro-extractor, washed until free from acid and dried by means of chequered steam pans, using steam of 30—40 lb. pressure, the mass being kept in motion to prevent caking.

The pulp may then be heated for 6—10 hours in a closed cylinder, fed from the bottom and relieved from the top side through suitable orifices, and having perforated shelves or baffle plates arranged internally, potassium carbonate being added in the proportion of 0·5 to 5·0. This drying and heating operation is effected by means of steam at 276° F. The water becomes discoloured, and the condition of the pulp may be ascertained by means of iodide of starch paper placed in the steam outlet. After drying, the pulp is mixed in an edge running mill with a paste of starch or amylose, prepared by mixing either of these materials with water and boiling to a gummy consistency, and with 5 per cent. of commercial charcoal and 10 per cent. of potassium nitrate, or proportions varying according to the nature of the explosive required. For large ordnance, about 8 per cent. of a normal paraffin, such as octane, may be added. The whole mixture is ground in the mill for 3—4 hours, and then dried in the steaming apparatus. A small quantity of barium nitrate may be added at this stage.

After passing the dry powder through fine sieves, it may be pressed or moulded to any required size or shape, and the granules, blocks, &c. may be waterproofed.—E. E. W.

Nitrocellulose, Impts. in the Treatment of. A. Luck, Dartford, and C. F. Cross, London. Eng. Pat. 18,233, Aug. 24, 1898.

The claims cover a process for hardening grains, consisting of nitrocellulose alone or compounded with restraining or other substances, by subjecting the soft grains to the action of a diluted solvent, washing, and drying; they also cover the products, simple or composite grains of nitrocellulose, hardened in this manner. The process depends upon the facts that whilst acetone itself completely gelatinises and dissolves cellulose nitrates, when diluted with 10 per cent. of water, it converts grains of soft guncotton into compact, more or less structureless grains, without dissolving them or causing them to cohere; these grains harden on drying. The composite grains are prepared by graining nitrocellulose mixed with graphite or other restraining substance, giving a product of restrained combustion and difficult igniting properties, and then adding to the grains, whilst still in the machine, some dry, pure nitrocellulose, which forms a coating outside the restrained grains readily ignited when used in firearms. The composite grains are then put through the above hardening treatment with dilute acetone in excess.—J. F. B.

Nitrocellulose, An Impt. in the Treatment of. A. Luck, Dartford, and C. F. Cross, London. Eng. Pat. 18,868, Sept. 3, 1898.

A process is claimed for increasing the stability of nitrocellulose by freeing it from the nitrating acid and treating it with a solution of a salt of a heavy metal, such as lead acetate or zinc chloride. The solutions obtained by treating nitrocellulose with diluted acetone, &c. (this Journal, 1899, 400), after further diluting and filtering, contain an acid substance or substances, which unite with metallic bases such as lead oxide, forming insoluble compounds. These precipitates when dried contain as much as 40—50 per cent. of PbO and "nitric nitrogen." The latter may amount to 3 per cent., and confers explosive properties on the compound. When these acid substances are combined with basic oxides, they are rendered relatively inert and incapable of upsetting the stability of the guncotton; and this may be effected by treating the cellulose nitrates with aqueous solutions of the metallic salts, or the action may be carried out in presence of acetone. In the former case, the guncotton is digested at 80°—100° C. with enough of a 1 per cent. solution of lead or zinc acetate to cover it. When the action is over, the excess of solution is removed, and the nitrate washed until free from soluble metallic salt. By covering the guncotton with acetone diluted with two or three times its weight of water in which about 1 per cent. of metallic salt (by weight of the diluted acetone) has been dissolved, the process is completed, at the ordinary temperature, in about half an hour.

The product contains about 2 per cent. of PbO. Products of satisfactory stability have been obtained by means of salts of lead, zinc, cadmium, calcium, barium, magnesium, and other metals, but salts of zinc, magnesium, and lead give the best results. Compounds of the metals with acids of low hydrolysing function, such as acetic acid, are preferred.

Certain metallic compounds, such as magnesium and calcium carbonates and mercuric chloride, have been used for increasing the stability of guncotton; the last-named has been shown, however, to interfere with the chemical reactions of the usual "heat test" (compare Simon Thomas, this Journal, 1898, 1179 and 1180).—E. W. W.

Explosives, Impts. in. W. Roos, Berlin. Eng. Pat. 7352, April 7, 1899.

A process of manufacturing explosives is claimed, which consists in the admixture of nitrate of sodium or potassium, either alone or with the addition of other oxidising agents, with di- or tri-nitro-substitution products of benzene, toluene and naphthalene. The following mixtures are quoted, (1) 65·5 parts of sodium nitrate; 34·5 of tri-nitronaphthalene (2) 70 of potassium nitrate, 30 of trinitronaphthalene (3) 64·5 of sodium nitrate 27·5 of trinitrotoluene, 8 of barium nitrate (4) 24·7 of dinitronaphthalene, 68·3 of sodium nitrate, 7 of lead nitrate. The nitro-compounds are fused by superheated steam and the well dried finely powdered oxidising agents intimately mixed with them.—E. W. W.

Engine Packing, the Manufacture of Dynamite and other Purposes; An Improved Material suitable for, and Methods of Preparing and Treating same. P. M. Justice, London. From The Marsden Company, Philadelphia, U.S.A. Eng. Pat. 6656, March 28, 1899.

See under V., page 756.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

PATENT.

Photometer, Illumination. C. W. S. Crawley, Clerkenwell, E.C. Eng. Pat. 19,087, Sept. 7, 1898.

The light from an amyl-acetate lamp, the flame of which is adjusted to a certain height, is thrown on a pivoted screen (preferably curved), which reflects it on to a second screen at the top of the case. This second screen is provided with a small hole or slit, through which the reflected light is visible. On turning the handle of the reflecting screen until the degree of illumination afforded by the reflected light is exactly equal to that prevailing on the outer side of the second screen, *i.e.* until the hole or slit does not appear to be lighter or darker than the rest of the screen, the value of the external illumination is indicated on a scale outside the case, by a pointer attached to the axis of the pivoted reflecting screen.—C. S.

INORGANIC CHEMISTRY.—QUALITATIVE.

Antimony from Tin, The Qualitative Separation of. G. Bornemann. Zeits. angew. Chem. 1899, [27], 635—636.

The tin in the liquid to be tested, must first be brought into the form of stannic chloride by treatment with hydrochloric acid and potassium chlorate. A drop of indicator is added, and sufficient caustic soda lye to give a clear solution with strongly alkaline reaction. When tin is present the resolution of the precipitate at first formed, is somewhat difficult, and a clear liquid is usually only obtained on warming. To the clear alkaline solution a sufficient excess of sodium phosphate is next added, and the whole made faintly acid with nitric acid. The liquid is boiled for some time and then left to settle. Under these conditions tin phosphate is insoluble, whilst antimony phosphate remains in solution. If no precipitate is obtained, the liquid is diluted somewhat, and boiled again. Complete absence of any precipitate, even after dilution, indicates absence of tin. The filtrate from the tin phosphate gives a pure orange precipitate of antimony sulphide on treatment with sulphuretted hydrogen.

The tin precipitate carries down with it some traces of antimony, and in addition to this objection, the author has not yet succeeded in obtaining it of constant composition, so that this method is not available for a quantitative separation.—J. F. B.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Phosphorus Hydride, Determination of, in Gaseous Mixtures. J. Riban. Comptes Rend. **128**, [24], 1452—1453.

The author's method (Comptes Rend. **88**, 581) of absorption of phosphine by acid cuprous chloride has been criticised by Joannis (this Journal, 1899, 709), who states that the reagent attacks mercury, and that cupric sulphate is a preferable absorbent. The author maintains that the acid cuprous chloride attacks the mercury only when partially converted into cupric salt by the air. Such a partially oxidised solution should be agitated with a globule of mercury to decolorise it, before it is introduced into the absorption vessel; then it will not attack the mercury, and will remain a colourless liquid after absorption of the phosphine (of which it absorbs 100 times its volume) so that it can be easily and cleanly removed from the apparatus. Cupric sulphate, on the other hand, forms, with the phosphine, a black flocculent precipitate of cupric phosphide, from which it is very difficult to free the vessels used.

—J. T. D.

Copper Oxalate, Composition of, and Separation of Copper and Cadmium. G. Bornemann. Chem. Zeit. 1899, **23**, [53], 565.

Copper is quantitatively precipitated by oxalic acid from hot neutral solutions of copper salts, even if four times the equivalent amount of oxalic acid be added, but the precipitate does not settle readily, and is difficult to filter, as it easily passes through the pores of the filter paper. More rapid settling and satisfactory filtration are attained with copper oxalate precipitated from a solution rendered faintly acid with nitric acid, but even in this case, a large excess of oxalic acid must be avoided, and a special filter paper for fine precipitates used for the filtration. The precipitate is washed with hot water containing a little oxalic acid. Analysis of the oxalate dried at 110° C., indicated the formula $6CuC_2O_4 + H_2O$.

With regard to the separation of copper and cadmium by means of oxalic acid, it was found that this is only possible in hot nitric acid solution, as only in this case is the separation of cadmium oxalate avoided; small quantities of this salt gradually separate on cooling the nitric acid solution. No more oxalic acid should be used than is equivalent to the copper and cadmium present, whilst nitric acid may be added in quantity equivalent to that of the oxalic acid without danger. Presence of ammonium compounds does not influence the separation unfavourably.

The following method is given:—The not too concentrated solution is made moderately acid with nitric acid, heated to boiling, and a boiling hot solution (saturated in the cold) of oxalic acid added, in amount rather greater than that equivalent to the copper present. The mixture is placed in the boiling water-bath and allowed to settle, when the supernatant liquid should be clear and colourless. The clear liquid is poured carefully through a special filter (for fine precipitates), the residue washed by decantation with hot water, to which has been added a few drops of nitric and oxalic acids, then washed on to the filter, and the washing finished, first with hot water containing a little oxalic acid, and then with hot, pure water. The residue of copper oxalate is dried, transferred as completely as possible to a Rose-crucible, the filter ash added, then the whole mixed with sulphur, heated in a current of hydrogen, and weighed as cuprous sulphide. If the oxalate contain any cadmium, a yellow stain of cadmium sulphide will be formed on the crucible and over the cuprous sulphide.

The cadmium in the filtrate is determined in the usual way.

The author prepared a solution containing 6·200 grms. of CuO and 9·885 grms. of CdO per 100 c.c., and proceeding by the above method, found in six trials, 6·178—6·244, average 6·210 grms. of CuO; and 9·806—9·998, average 9·872 grms. of CdO per 100 c.c.—A. S.

Gold, Researches on; Quantitative Estimation and Separation from Platinum and Iridium. L. Vanino and L. Leemann. Ber. 1899, **32**, [11], 1968.

The quantitative estimation of gold by means of an alkaline formaldehyde solution has recently been much in favour. It is simple and requires no special skill. The authors have devised another method, equally simple and accurate, based on the fact that gold chloride is reduced to metallic gold by hydrogen peroxide and caustic potash or soda. It is already known, that in neutral solutions the reaction takes place according to the equation :—

$$2\,AuCl_3 + 3\,H_2O_2 = 2\,Au + 6\,O + 6\,HCl.$$

In alkaline solutions, however, the reaction, even in the cold, is instantaneous. The metal falls as a black precipitate, which agglomerates on warming, with copious evolution of oxygen gas. It is well to warm the solution after precipitation, not before, as chlorine might be formed and dissolve some gold. Then some hydrochloric acid should be added. The precipitate will thus be obtained in a physical condition suited for easy filtration and washing. The following table shows the accuracy of this method compared with methods in which other reagents are used. 10 c.c. of the solution were employed in each case and five minutes allowed. All the tests were performed in the cold.

Amount of Gold.	0·003 Grm.	0·0015 Grm.	0·0012 Grm.	0·0009 Grm.	0·0006 Grm.	0·0003 Grm.	0·00015 Grm.	0·00012 Grm	0·00009 Grm.	0·00006 Grm.	0·00003 Grm.
Ferrous sulphate.	Brown precipitate.	Brown precipitate.	Brown precipitate.	Brown precipitate.	Blue coloration.	Steel blue coloration with surface lustre.	Bluish coloration.	Bluish coloration.	Bluish coloration.	Bluish coloration, very faint.	..
Formaldehyde + KOH.	Black precipitate.	Black precipitate.	Black precipitate.	Black precipitate.	Black precipitate.	Dark violet coloration.	Dark violet coloration.	In transmitted light, faintly violet : in reflected light, stronger.	In transmitted light, faintly violet.	Faint blackish, almost imperceptible.	..
Mercurous nitrate.	,,	,,	,,	,,	,,	Grey coloration, due to very finely divided mercury.	Grey coloration.	Grey coloration.	Grey coloration.	Grey coloration.	..
Ammonium sulphide.	Dark yellow coloration.	..	..	..	..	..	..	..	..	..	..
Sulphuretted hydrogen.	Brownish black precipitate.	Dark brown coloration.	Dark brown coloration.	Dark brown coloration.	Light brown coloration.	Faint brown coloration.	Yellow coloration.	Yellow coloration.	In reflected light, yellowish ; in transmitted, colourless.	..	..
Hypophosphorous acid.	Red-brown precipitate.	Bluish coloration.	Faint bluish coloration.	..	..	..	..	..	..	..	..
Hydrogen peroxide + KOH.	Black precipitate.	Black precipitate.	Black precipitate.	Black precipitate.	Dark blue coloration.	Blue coloration.	Blue coloration.	Blue coloration.	Blue coloration.	Bluish coloration, reaction marked.	Faint reddish coloration, with bluish lustre
Stannous chloride.	Brown precipitate.	Brown precipitate.	Brown precipitate.	Brown precipitate.	Brown coloration.	Brown coloration.	Yellow coloration.	Yellow coloration.	Yellow coloration.	Yellowish coloration.	..

Mention should be made of the fact that sodium nitrite with 0·003 grm. of Au produces gradually a brown, and sodium carbonate, after warming, a bluish-green coloration, whilst oxalic and sulphurous acids do not appear to act at all.

The authors have further tested a gold reaction described in the Pharm. Centr. **27**, 321. The directions are thus given :—Add to a few drops of a dilute gold solution a few drops of arsenic acid, 2—3 drops of ferric chloride and the same of hydrochloric acid ; dilute with 100 c.c. of water and introduce a piece of zinc. Around the zinc a purple coloration will then appear which, on shaking, will distribute itself through the whole solution. This coloration is permanent for upwards of half an hour. This reaction was perceptible with 0·00003 grm. of Au per 10 c.c. of liquid, but failed when the dilution reached 0·000015 grm. of Au.

Silver may also be quantitatively estimated by means of hydrogen peroxide and caustic potash. Since platinum is not precipitated in the cold, gold may easily be separated from it. The platinum, in the filtrate from the gold precipitate, may be determined by precipitation with H_2S. In the same manner, gold and iridium might be separated. Ruthenium, on the other hand, behaves towards hydrogen peroxide as gold does.—S. K.

ORGANIC CHEMISTRY.—QUALITATIVE.

Cocaine Test, The McLagan. C. Boehringer and Soehne. Chem. and Druggist, 1899, **55**, [1015], 59.

Günther has stated, in a paper read before the Deutsche Pharmaceutische Gesellschaft on February 2, that carefully purified cocaine, free from foreign alkaloids and normal in physiological action, does not give the McLagan reaction, whilst a cocaine containing a small quantity of a new base (m.p. 111° C.) discovered by him, responds to the test.

If this statement were correct, it would follow that nearly all the cocaines in the trade are impure, but contain small quantities of this base: therefore the authors endeavoured to obtain evidence of the existence of the base in a large quantity of coca leaves operated upon especially for that purpose. The alkaloidal mixture obtained was converted into hydrochloride by partial neutralisation, and then recrystallised in fractions ; whilst the mother liquors of the cocaine hydrochloride were also subjected to the same treatment. The only instance in which any evidence was obtained of a base having a higher melting point than cocaine was in the mother liquor of cocaine hydrochloride, which yielded a very small quantity of a base melting at 104° to 106° C. Examination of ordinary commercial cocaine hydrochloride gave similar results. From synthetic cocaine liquors, a base was obtained which, after careful purification with petroleum ether and final crystallisation from alcohol, melted at 109·5°—110° C. (corrected).

The authors also prepared chemically pure cocaine from benzoyl ecgonine (m.p. 195° C.) and chemically pure methyl alcohol produced from methyl oxalate. From the base thus prepared, a hydrochloride was obtained melting at 97·25° C. (uncorrected) which gave the crystalline separation by McLagan's test in an excellent manner in a solution of 0·1 in 100 in 0·5—1 minute.

In conclusion the authors state that they could not obtain from coca leaves a base melting at 111° C., and that the extremely small quantity (0·00006 per cent.) of the base melting at 101—106° C. is quite insufficient to account for the crystalline precipitate by McLagan's test. They therefore still recommend the use of the McLagan test, as with its help, the presence of the poisonous isatropyl-cocaine can be easily proved, but the dilution should be 0·1 to 85, because with a greater dilution (0·1 to 100) the crystalline separation is delayed and gives rise to erroneous conclusions. (See this Journal 1899, 522 and 612.)—A. S.

Cocaine, The Chromic Acid Test for. G. L. Schaefer. Pharm. J. 1899, **63**, [1517], 66. See also this Journal, 1899, 522 and 612.

In reply to the statements that the chromic acid test is too delicate and that only a synthetic cocaine would stand it, it is stated that the finest commercial brands of cocaine hydrochloride satisfactorily respond to the test.

With regard to the criticisms of Merck (this Journal, 1899, 713) as to the influence of the strength of the hydrochloric acid used in the test, the author states that the difference in the results is due to the fact that the sample of cocaine examined contained only very minute traces of amorphous alkaloids; the chromates of these latter bodies being far less soluble in the solution containing the higher percentage of hydrochloric acid. An acid of 10 per cent. strength should be used, as it is sufficient to indicate such very small traces of amorphous impurities that only the very best brands of cocaine in the market will stand the test, and if this test be used in conjunction with the permanganate test, a purity of product is guaranteed which cannot be obtained when McLagan's test is taken as the standard.

The author disagrees with Merck's statement that the results are influenced by the age of the chromic acid solution.

In applying the chromic acid test, it is important that the temperature of the cocaine solution be maintained at 15° C., the chromates of both pure cocaine and the amorphous alkaloids being influenced by rise and fall of temperature, heat increasing and cold diminishing their solubility.

In a note to the above communication, A. J. Cownley maintains that for commercial purposes, McLagan's test is to be preferred to the chromic acid test for ascertaining the purity of cocaine hydrochloride, and he considers that this opinion is maintained by Schaefer's own statement that specimens of cocaine hydrochloride which gave negative results—that is were condemned—by McLagan's test, were also shown to be impure by the chromate test. Cownley also repeats that probably the only salt that would pass the chromic acid test would be one prepared from synthetic cocaine.—A. S.

Sesamé Oil, Notes on Baudouin's Reaction for. W. Kerp. Zeits. f. Untersuch. Nahr. u. Genussmittel. 1899, **2**, [6], 473—480.

Commercial furfural, which is generally of a yellow to yellowish-brown colour, can be purified by double distillation under reduced pressure for use in the above test. The pure substance as thus obtained is a colourless, mobile liquid, which boils at 62·5° to 63° C. under a pressure of 18 mm., at 63·5° to 64° C. under 20 mm., and at 65·5° to 66° C. under 22 mm. pressure. After standing for a short time it begins to turn dark, even when air is excluded from the bottle, and as the process of darkening continues, a perceptible acid reaction is developed. When dissolved in alcohol it is more stable. A 20 per cent. solution can be kept for a long time without undergoing alteration, and a solution containing 1 c.c. of furfural in 100 c.c. of alcohol keeps almost indefinitely.

Colourless furfural is readily soluble in fuming hydrochloric acid, but the solution changes after a few moments to violet, then to wine-red, and finally to black, with the simultaneous deposition of a black precipitate. Alcoholic solutions of furfural behave in an analogous manner, but the reaction in this case depends on several conditions. From the results of the author's experiments on the action of hydrochloric acid of different degrees of strength on the same alcoholic solution of furfural (0·99 per cent. by volume), it appears that an acid of sp. gr. 1·127 cannot produce the characteristic reddish-violet coloration. At most, the solution turns dark grey after standing for 18 hours or being warmed for 30 minutes. With acid of sp. gr. 1·16, no distinct coloration results at the ordinary temperature, but on warming the liquid containing 0·1 c.c. of the furfural solution to from 40° to 65° C., a dirty yellow colour is obtained after about 30 minutes. Only with solutions containing more than 0·1 c.c. of a 0·99 per cent. solution of furfural is any violet coloration to be observed. Comparative tests showed that the Baudouin test could be obtained with acid of sp. gr. 1·127, but that the coloration was less marked than in the case of the stronger acid. The author therefore advocates the use, in doubtful cases, of acid of 1·16 sp. gr., which he asserts cannot lead to any mistake, even on heating the liquid to 40° to 50° C., provided that not more than 0·1 to 0·2 c.c. of the 0·99 per cent. solution of furfural be used.

Referring to Sohn's recent proposal (Milchzeit. 1898, **27**, 498) to use furfuramide in place of furfural, the author states that, in his opinion, no advantage would result therefrom, since it is not an easy matter to prepare pure white furfuramide, nor is that substance more stable than furfural. Moreover, its alcoholic solution has itself a faint yellow tinge, and on treatment with hydrochloric acid gives an intense greenish-yellow salt which is decomposed into furfural and ammonium chloride as a secondary reaction.

As regards the limits of the Baudouin reaction, the author finds that the smallest quantity of sesamé oil which can be detected with certainty at the ordinary temperature lies between 0·0050 and 0·0025 grm., provided that the concentration of the sesamé oil solution be not less than 2·5 per cent. The more the dilution of the sesamé oil mixture the greater must be the absolute quantity of the oil to obtain a perceptible coloration. The greatest possible dilution was reached with a solution containing 0·20 per cent. of oil, and from this the author concludes that in practice 2 to 2·5, grms. of sesamé oil, corresponding to 20 to 25 grms. of margarine (containing 10 per cent. of the oil), can be detected in 1 kilo. of butter.

When a sesamé oil reaction has been obtained with a genuine butter free from margarine, the author considers that it has probably been due to some error in applying the test or to subsequent contamination of the milk with sesamé oil.

On diluting the clear red solution obtained in the test with water, the liquid becomes thick and orange coloured, and on treatment with ether a portion of the yellow colouring matter dissolves, although the original colouring substance was not soluble in that liquid. When the ethereal solution is shaken with strong mineral acids the colouring matter is extracted from the ether and the acid becomes red again. The author's explanation of this is that the characteristic constituent of sesamé oil combines with the furfural to form a compound which unites with the acid, forming a red substance, and that this is decomposed on the addition of water, with the liberation of the acid.

—C. A. M.

Oleomargarine, The Adulteration of, with Paraffin [Detection]. J. F. Geisler. J. Amer. Chem. Soc. 1899, **21**, [7], 605.

See under XVIII. A., *page* 780.

Lemonade, Analyses of [Detection of Saponine]. Frehse. J. Pharm. Chim. 1899, **10**, [1], 13.

See under XVIII., A., *page* 780.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Carbon and Hydrogen, The Determination of, in Organic Substances containing Nitrogen. O. F. Tower. J. Amer. Chem. Soc. 1899, **21**, [7], 596—605.

The work of Liebig (Pogg. Ann. **18**, 357), Klingemann (Ber. **22**, 3064), and Dibbits (Zeits. anal. Chem. **15**, 148) is referred to, and the well-known use of the copper spiral in the combustion of organic substances containing nitrogen are referred to.

The object of the author's investigation was to determine whether oxides of nitrogen are invariably produced in the combustion of all kinds of nitrogenous organic compounds, thus rendering imperative the invariable use of a metallic copper spiral.

From the results obtained with pure specimens of various classes of such organic compounds, it appears that amido compounds, of which urea, hippuric acid, and toluidine were taken as representative, do not yield oxides of nitrogen which can be absorbed by soda-lime or by concentrated sulphuric acid. A spiral coil is therefore not required in making a combustion of these bodies.

Of the nitro compounds tried, *viz.*, nitraniline, nitrobenzene, and picric acid, only the last gave nitric oxides absorbed by the reagents. The author considered that the oxide absorbed consisted for the most part of nitrogen peroxide.

Possibly nitric oxide is produced to a small extent in the combustion, but unless it be further oxidised, it has no influence on the results of the carbon or hydrogen determinations, since it is not absorbed by concentrated sulphuric acid or by soda-lime.—C. A. M.

Sugar, Iodometric Estimation of, by means of Fehling's Solution. N. Schoorl. Zeits. angew. Chem. 1899 [27], 633—635.

In the Lehmann and de Haën method modified by Maquenne, who acidifies strongly with sulphuric acid, the author considers that such an excess of sulphuric acid is undesirable. (Sitzungsberichte der phys. med. Ges. Würzburg (11) 3, 1897.) (Also Bull. Soc. Chim. **20**, 22, 926.) Results agreeing with the gravimetric determinations can be obtained if a fair excess of potassium iodide be used, and if this be added to the alkaline liquid prior to acidification. Naturally the conditions laid down by the compilers of the tables used must be rigidly adhered to. The author however describes the following modification as being more convenient:—10 c.c. of Fehling's copper solution (10 c.c. = 27·74 c.c. $\frac{N}{10}$-thiosulphate) are mixed with 10 c.c. of Soxhlet's alkaline tartrate solution in an Erlenmeyer flask of 200 c.c. capacity. Water is added to make up 50 c.c. and the contents of the flask are boiled for 2 minutes on wire gauze, over which is placed an asbestos ring having a hole 6 cm. in diameter. The liquid is then quickly and thoroughly cooled under the tap and 10 c.c. of a 20 per cent. solution of potassium iodide and 10 c.c. of 25 per cent. sulphuric acid (1·5 of conc. acid with 8·5 of water by volume) are added. The iodine liberated is immediately titrated with decinormal thiosulphate with the addition of starch until the blue colour changes to cream. After this blank experiment, a similar one in every respect is made, introducing a known quantity of sugar solution in place of some of the water making up to 50 c.c. Not more than 90 mgrms. of glucose or invert sugar or 125 mgrms. of lactose should be taken, and in the determination of lactose, the liquids should be boiled for 5 minutes instead of 2. When the sugar is impure care should be taken to determine whether there is any impurity capable of combining with iodine.

The author has compiled tables for use with the above method, from determinations actually made.

The values for amylum ($C_6H_{10}O_5$) have not been found experimentally, but are simply 0·9 times the glucose values; according to Lippmann, maltose only yields 90·6 per cent. of the theoretical glucose, so that these values should be increased 1·4 per cent. (See also Riegler, this Journal, 1898, 499.)—J. F. B.

Acetylene, Analysis of, and Notes on the Manufacture of Calcium Carbide. G. Hanekop. Zeits. angew. Chem. 1899 [25], 592.

See under II., *page* 742.

Lemonade, Analyses of. Frehse. J. Pharm. Chim. 1899, **10**, [1], 13.

See under XVIII., A., *page* 780.

Tanning Liquors, Testing the Acidity of. Paessler and Spanjer. Zeits. angew. Chem. 1899, [27], 636.

See under XIV., *page* 773.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Double Salts, Contributions to our Knowledge of Aqueous Solutions of.—II. Chlorides. H. C. Jones and Kenjiro Ota. Amer. Chem. J. 1899, **22**, [1], 5—14.

The electrolytic conductivities of certain double chlorides were determined and compared with the sum of the conductivities of their constituents at the corresponding dilution. The difference between the observed and calculated values amounts to 40 per cent. for $2KCl.ZnCl_2$, 26 per cent. for $KCl.CdCl_2$, 13 per cent. for $NaCl.AlCl_3$, and 12 per cent. for $2NH_4Cl.HgCl_2$ in concentrated solutions; in dilute solutions the difference disappears. The conclusion is that molecules of double salts exist in the more concentrated solutions. The double chlorides are much less dissociated than the double sulphates.—A. C. W.

Nickel and Cobalt, The Thermal Expansion of Pure. A. E. Tutton. Proc. Roy. Soc. 1899, **65**, [415], 161—162.

The author has carried out a series of re-determinations of the coefficients of thermal expansion of pure nickel and cobalt with the aid of the interference dilatometer (Proc. Roy. Soc. **63**, 208).

The results may be stated as follows:—The coefficients of linear expansion α of pure nickel and cobalt exhibit a slight but real difference, that of nickel being greater than that of cobalt. This is true with respect to both the constant a, the coefficient for 0°; and the increment per degree, $2b$, of the general expression for the coefficient at any temperature, t; $\alpha = a + 2bt$.

The metal possessing the slightly lower atomic weight, nickel, is thus found to expand to a greater extent than the metal, cobalt, which has the higher atomic weight.—A. S.

Azelone. W. Miller and A. Tschitschkin. Annalen, **307**, [3], 375—383.

By distilling small quantities (30 grms.) of a mixture of equal weights of azelaïc acid and soda lime from a hard glass retort, the authors obtain 30 per cent. of the weight of the acid of a crude product containing azelone (octomethylene ketone). The substance $C_8H_{14}O$ is purified by means of its oxime, boils at about 205° C., and is not very stable at high temperatures, either under ordinary or reduced pressure. It gives crystalline compounds with sodium bisulphite and with semicarbazide, and is converted on oxidation into dibasic suberic acid.—T. A. L.

Educational Research Fellowships.

The Research Fellowships founded by the Salters' Company and the Leathersellers' Company for the encouragement of higher research in chemistry in its relation to manufactures, tenable at the City and Guilds Central Technical College, being now vacant, The Executive Committee of the City and Guilds of London Institute will, before the commencement of next session, consider applications and elect candidates.

The grant made by each of the Companies to the Institute for this purpose is 150*l* a year. Copies of the schemes under which the Fellowships will be awarded, may be had on application to the Honorary Secretary of the Institute, Gresham College, Basinghall Street, E.C.

John Watney,
Honorary Secretary.

The National Physical Laboratory. Chem. Trade J., Aug. 19, 1899, 119.

The realisation of the scheme for the establishment of a National Physical Laboratory is primarily due to two addresses delivered before the British Association in 1891 and 1895 by Professor Oliver Lodge and the late Sir Douglas Galton respectively. The fact that Sir Douglas Galton, when president of the association, did all in his power to support the proposal originally made by Professor Lodge, led to the matter being laid before the Prime Minister by a strong deputation.

A committee, of which Lord Rayeigh was chairman, was then appointed by the Treasury, and, after taking evidence, reported in favour of the establishment of a public institution for standardising and verifying instruments, for testing materials, and for the determination of physical constants. They further recommended that the institution should be established by extending the Kew Observatory in the Old Deer Park, Richmond, and that the Royal Society should be invited to control it and to nominate a governing body, on which commercial interests should be represented, the choice of the members of such body not being confined to Fellows of the society.

These recommendations were approved, and to give effect to them the Government undertook to ask Parliament for 12,000*l*. for buildings, and for 4,000*l*. a year. A scheme for the management of the new institution has been approved by the Treasury, and the first instalment of the promised grants has been sanctioned by the Legislature. The Kew Observatory Committee are willing that the institution which they have managed very successfully should be merged in the National Physical Laboratory, which will thus become possessed of an endowment of 458*l*. per annum from the Gassiot trust and of an income of about 2,700*l*. from fees for standardising. These receipts have, in the past, rather more than covered the expenses of carrying on the work of the observatory.

The ultimate control of the National Physical Laboratory is placed in the hands of the Royal Society, but the constitution of the bodies which manage it directly can only be altered with the consent of the Treasury. These are an executive committee and a general board. The latter is a relatively large body to which the executive committee must report annually, and to which it must submit its scheme of work for the next year. An essential feature in the constitution of the general board is that 12 of its members are nominated by six of the great technical societies—viz., the Institutions of Civil, Mechanical, Electrical and Naval Engineers, the Iron and Steel Institute, and the Society of Chemical Industry. Six of these representatives of "commercial interests" are also to be members of the executive committee, which will ultimately consist of 12 ordinary and five official members, of whom the latter are the president of the Royal Society, the chairman of the committee, the Permanent Secretary of the Board of Trade, and the treasurer and one of the secretaries of the Royal Society. In the first instance, six members of the existing Kew Observatory Committee will also have seats on the executive committee, but their places will not be filled up when their period of office expires. Finally, it is in the power of the executive committee to appoint sub-committees to superintend particular departments or investigations. The members of these sub-committees need not necessarily be members either of the general board or of the executive committee.

Preliminary arrangements have been in progress for some time in order that the National Physical Laboratory should be organised as soon as possible after the requisite funds were voted by Parliament.

The six technical societies have nominated their representatives, the general board and executive committee have been constituted, and general satisfaction will be felt at the announcement that Lord Rayleigh has accepted the chairmanship of these bodies.

On the recommendation of the executive committee, the council of the Royal Society has appointed Mr. R. T. Glazebrook, F.R.S., now principal of University College, Liverpool, to the post of director of the National Physical Laboratory. A number of sub-committees have also been organised by the executive committee, which have been requested to make suggestions preparatory to the drawing up of a detailed scheme of work and of the plans of the new buildings.

The members of the executive committee are Lord Lister, P.R.S., Lord Rayleigh (chairman), Mr. A. B. Kempe, Treas. R.S., Prof. A. W. Rücker, Sec. R.S., and Sir Courtenay Boyle (*ex officio*), Captain W. de W. Abney, Sir N. Barnaby, Mr. G. Beilby, Sir E. H. Carbutt, Captain E. W. Creak, R.N., Prof. R. B. Clifton, Prof. G. C. Foster, Mr. F. Galton, Prof. O. J. Lodge, Sir A. Noble, Prof. J. Perry, Sir W. Roberts-Austen, Prof. A. Schuster, Mr. A. Siemens, General Sir R. Strachey, Prof. J. J. Thomson, Dr. T. E. Thorpe, and Sir J. Wolfe Barry.

In addition to the above, the following are also members of the general board:—Sir M. Foster, Sec. R.S. (*ex officio*), Sir F. A. Abel, Professer W. G. Adams, Professor W. E. Ayrton, Mr. H. Bell, Mr. A. Buchan, Mr. R. E. Crompton Professor G. F. Fitzgerald, Professor J. Joly, Lord Kelvin Mr. J. T. Milton, Sir W. H. Preece, Mr. W. F. Reid, the Earl of Rosse, Dr. R. H. Scott, Mr. W. N. Shaw, Mr. C. E. Stromeyer, Admiral Sir W. Wharton, and Sir W. H. White.

The following have also been requested to serve on one or other of the sub-committees referred to:—Messrs. E. D. Archibald, C. V. Boys, Professor H. L. Callendar, Messrs. Forbes Carpenter, W. H. M. Christie, J. H. Dallmeyer, Professor J. A. Ewing, Mr. S. Z. de Ferranti, Professor J. A. Fleming, Messrs. R. E. Froude, E. H. Griffiths, J. Mansergh, T. Matthews, W. H. Maw, Dr. L. Mond, Hon. C. A. Parsons, Professor A. W. Reinold, Captain H. R. Sankey, Messrs. J. Swinburne, G. J. Symons, H. A. Taylor, Professor S. P. Thompson, Messrs. J. I. Thornycroft, C. H. Wordingham, and A. F. Yarrow.

A definite scheme of work will be arranged during the autumn and the director will, it is hoped, take up the duties of his Office on January 1st, 1900, and the planning and erection of the new buildings will then proceed with as little delay as possible.

New Books.

Les Médicaments Chimiques. Par Léon Prunier. Professeur de Pharmacie Chimique à l'École Superieure de Pharmacie, &c. Deuxième Partie : Composés Organiques. Masson et Cie., Editeurs, 120, Boulevard Saint-Germain. 1899. Price 15 fr.

8vo volume, forming the second part of the entire work, and containing preface, table of contents, and subject-matter extending to page 804. The work ends with an alphabetical index of subjects extending from page 805 to 832. The subjects treated of, and their subdivision, proceed as follows:—I. Hydrocarbons. Petroleums, &c. II. Acyclic Hydrogen Carbides. Amylenes. Methane Derivatives. Chloroform. III. Acyclic Hydrogen Carbides. Substitution Derivatives. Bromoform, Iodoform, &c. Sulphonals. Ethane Derivatives. IV. Cyclic Carbides. Essence of Terebenthine. Cymene. Caoutchouc. Gutta-Percha. Eucalyptol, &c. V. Benzene and its Derivatives. Thiophen. Naphthalene. VI. Monovalent Alcohols. Methyl Alcohol, &c. VII. Ethyl Alcohol. VIII. Ethers of Vinic Alcohol. IX. Action of Sulphuric Acid on Alcohol. Sulphonates, &c. Ether, &c. X. Monovalent Saturated Alcohols. Alcohols of Higher Fermentation. XI. Allyl Alcohol and Ethers. Menthol. Cholesterins. XII. Alcohols derived from Terebenthine Carbides. Terpenes, &c. XIII. Glycerin. XIV. Glyceric Esters. Glycerophosphates, Fats and Oils, &c. XV. Sugars. Mannites. Pentoses, &c. XVI. Glucoses. Hexoaldoses, &c. XVII. Saccharose (Cane Sugar). XVIII. Lactose. Maltose, &c. XIX. Polysaccharides. XX. Glucosides. XXI. Glucosides. XXII. Phenols. XXIII. Naphthols. Cresols, Ethyl-Phenols, &c. XXIV. Polyvalent Phenols. Pyrocatechol, &c. XXV. Wood Creosote. Tannins. XXVI. Aldehydes. Formaldehyde, &c. XXVII. Aldehyde (ordinary). XXVIII. Chloral and Bromal, &c. XXIX. Aromatic Aldehydes. XXX. Acetones. Camphors. XXXI. Monovalent and Monobasic Acids. XXXII. Fat Acids, Soaps, &c. XXXIII. Oxalic Acid and Oxalates; Succinic Acid and its Salts. XXXIV. Lactic Acid and Lactates. XXXV. and XXXVI. Tartaric Acid. XXXVII. Citric Acid and Citrates, &c. XXXVIII. and XXXIX. Salicylic Acid and its Salts. Salols, &c. XL. Nitrogen Bases. XLI. to XLIX. Alkaloids and Derivatives, &c. L. and LI. Ptomaïnes, &c. LII. Amides, Urethanes, Anilides, &c. LIII. and LIV. Albuminoids and Peptones. LV. Non-classified Bodies, Picrotoxine, Quassine, &c.

Jahrbuch der Chemie. Bericht über die wichtigsten Fortschritte der reinen und angewandten Chemie, unter Mitwirkung von H. Beckurts, C. A. Bischoff, E. F. Dürre, J. M. Eder, P. Friedländer, C. Häussermann, F. W. Küster, J. Lewkowitsch, M. Märcker, F. Röhmann, K. Seubert. Herausgegeben von Richard Meyer. VIII. Jahrgang. 1898. Friedrich Vieweg und Sohn, Braunschweig. 1899. Price M. 15.

8vo volume, bound in cloth, containing a report for the year 1898 of the progress of pure and applied chemistry during that period. The subject-matter fills 510 pages. It is preceded by a table of contents and followed by alphabetical indexes referring to subjects and authors. The various brances of pure and applied chemistry treated of are as follows:—

I. Physical Chemistry (F. W. Küster). II. Inorganic Chemistry (Karl Seubert). III. Organic Chemistry (C. A. Bischoff). IV. Physiological Chemistry (Fr. Röhmann). V. Pharmaceutical Chemistry (H. Beckurts). VI. Chemistry of Foodstuffs (H. Beckurts). VII. Agricultural Chemistry (M. Märcker and W. Naumann). VIII. Metallurgy (E. F. Dürre). IX. Fuels and Explosives. Inorganic Chemical Technology (C. Häussermann). X. Technology of Carbohydrates and Fermentation (M. Marcker, W. Naumann, and L. Bühring). XI. Technology of Fats and Petroleums (J. Lewkowitsch). XII. Chemistry of Coal-tar and Dyestuffs (Richard Meyer). XIII. Chemical Technology of Textile Fibres (P. Friedländer). XIV. Photography (J. M. Eder and E. Valenta).

Trade Report.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

ASPHALT, RUBBER, AND DRUGS IN VENEZUELA.

Foreign Office Annual Series, No. 2315, *July*, 1899.

Asphalt.

One of the most noticeable sources of mineral wealth at this moment lying waste is that of the asphalt lakes, apparently forming part of the same system in which is included the famous pitch lake in the neighbouring island of Trinidad, a source of revenue to the Colonial Government last year of 33,998*l.*, while the value in Trinidad of the asphalt exported was 113,817*l.*; these figures are taken from last year's annual report of the Trinidad Collector of Customs, who also remarks: "Venezuelan deposits of asphalt are practically unlimited, and in some respects of better quality than those of Trinidad."

Two of these lakes lie close to the sea, but an American company began operations there recently, and has sent one or two shiploads of asphalt to the United States.

Drugs.

The British drug trade does not compete with the German. This is probably owing to the fact that while there are numbers of German commercial travellers, there are no British, which is to be regretted, as an immense amount of medicine is dispensed, and the chemists' shops are out of all the usual proportion to the number of the inhabitants. British patent medicines should have a ready sale. In drugs, chemicals, oils, cement, and perfumes, the United States and Germany take a large share of the trade.

Balsam-copaiba continues with a very perceptible increase; in 1898 there was exported 35,778 kilos., against 22,467 kilos. in 1897.

The export of quina-bark and dividivi has become less than in former years, owing to its very low prices in the foreign markets.

Rubber.

The balata rubber industry has increased in importance during 1898, over 500 tons being exported. This rubber is extracted from the bullet-wood tree, of which vast forests exists in the country south of the Orinoco. The price in the London market is about 1*s.* 3*d.* per lb., which is a remunerative figure. Instead of tapping the bark, which would admit of an annual crop, the trees are cut down to facilitate the extraction of the juice. The consequence is that the workers have to move on as the forests become exhausted, and they are now already in some places working at considerable distances from the centres.

WOOD PULPS IN SWEDEN IN 1898.

Foreign Office Annual Series, No. 2317, *July* 1899.

Chemical wood-pulp, sulphate and sulphite, have found good markets during the past year and enjoyed regular sales at remunerative prices. The fears that the produce of so many new mills could not be absorbed in the markets showed themselves groundless, and the year ended with tendencies rather towards a rise than a fall in prices. Swedish exporters think that it has not yet been clearly proved that the United States or Canada can produce equally good cellulose at cheaper rates than Scandinavia.

Prices during the year have been estimated at:—

For	Per Ton, f.o.b., in a Swedish Port, according to Quantity and Time of Year.			
	Currency.		Sterling.	
	From	To	From	To
	Kroner.	Kroner.	£ s. d.	£ s. d.
Sulphite............	140	150	7 15 6	8 6 8
Sulphate............	130	140	7 4 5	7 15 6

In mechanical wood-pulp the conditions have been unfavourable with falling prices, due to the influence of considerable exports to Europe from the United States and Canada.

Prices improved, however, at the end of the year, and it was then hoped that, as the American exports to Europe had, generally speaking, given but unremunerative results, the manufacture of this article may yet be made to pay in Sweden.

Prices during 1898.

For	Per Ton, f.o.b., in Swedish Ports, according to Quality and Time of Year.			
	Currency.		Sterling.	
	From	To	From	To
	Kroner.	Kroner.	£ s. d.	£ s. d.
Mechanical dry pulp	60	70	3 6 8	3 17 9
„ wet „	28	32	1 11 1	1 15 6

WIBORGH'S PHOSPHATE IN SWEDEN IN 1898.

Foreign Office Annual Series, No. 2317, *July* 1899.

The artificial manure manufactured at Lulea last year amounted to 2,000 tons. Is is estimated that this manufacture will increase largely, and the output of manure (Wiborgh's phosphate) for this year is calculated at 10,000 tons. The article finds ready sale within the country.

OPENING FOR LINOLEUM FACTORY AT BARCELONA.

Foreign Office Annual Series, No. 2309, *July* 1899.

H.M. Consul suggests that the manufacture of linoleum and similar articles might be carried on with advantage in Cataluña. The principal materials required, cork shavings and jute waste, are to be obtained in the neighbourhood. The cork shavings from the numerous factories in the department of Geroma are now shipped in pressed bales from the small ports of Palamos and San Felin de Guixols (distant about 50 miles from Barcelona) to Kirkcaldy Roads for consumption in the linoleum mills in that district. The freight, about 25*s.* per ton, would be saved if the manufacture were carried on here, and labour could be obtained certainly at a cheaper rate than in Great Britain.

BOOT LEATHER IN MINORCA.

Foreign Office Annual Series, No. 2309, *July* 1899.

H. M. Consul at Mahon calls the attention of British manufacturers to the fact that all the imported materials, especially leather and patent leather, used in the boot factories come from France, Germany, and the United States, and none from Great Britain. The reason for this is stated to be that the leathers of English make are not suited to the conditions required in the shoes that are exported to the Antilles. It would be worth the consideration of the British leather manufacturers to make classes similar to those used in the boot and shoe factories here, and which now come from France, Germany, and the United States. The trade is of sufficient importance to be worth serious consideration.

IMPORTS TO AND EXPORTS FROM BARCELONA DURING 1897 AND 1898.

Foreign Office Annual Series, No. 2309, *July* 1899.

Imports.

Articles.	1897. Quantity.	1897. Value.	1898. Quantity.	1898. Value.
	Tons.	£	Tons.	£
Wine and beer	49	6,319	55	2,167
Mineral waters	321	7,505	215	4,950
Clay, cement, lime	12,477	24,788	8,889	17,778
Tar, pitch, &c.	2,775	9,253	1,154	3,877
Petroleum, benzine, &c.	7,925	52,831	5,711	38,150
Minerals	1,496	997	275	280
Tin	311	15,884	126	6,436
Copper, brass, zinc	349	16,269	255	7,533
Oil seeds	14,114	169,366	12,780	149,782
Wood for dyeing	180	3,866	871	5,845
Indigo and cochineal	85	31,620	101	37,537
Wax	830	37,983	1,039	44,345
Pulp for paper	1,911	12,106	2,421	17,431
Animal greases	8,689	231,763	2,081	55,604
Manure	2,947	20,631	3,391	28,960
India-rubber	45	10,885	70	17,940
Sulphur	15	181	164	498
Charcoal	..	..	33,566	122.180
Glassware	1,830	51,863	1,982	56,487
Pottery, porcelain, &c.	177	11,785	152	13,068
Soap	45	831	60	910
Drugs	1,975	72,426	2,840	90,889
Colours, varnish, inks	1,099	55,443	1,159	94,036
Dry extracts	1,824	63,833	1,226	42,910
Medicines	143	23,936	145	30,104
Chemical products	20,918	244,043	17,102	243,532
Perfumery	52	13,879	39	10,335
Starch	9,678	116,137	436	9,592
Paper	1,169	50,201	932	74,290
Tanned hides	75	35,473	58	28,188
Machine oil	366	7,669	810	17,010
Waterproof goods	..	..	57	12,685
Cocoa and palm oils	..	..	106	2.493
Vegetable oil	..	..	94	2,448

Exports.

Articles.	1897. Quantity.	1897. Value.	1898. Quantity.	1898. Value.
Mineral waters	665	16,630	520	16,659
Saffron	19	29,451	18	53,010
Anise, cumin, pimento	362	10,262	675	21,684
Olive oil	2,138	75,587	19,174	680,677
Tar, pitch, &c.	1.474	12.282	1,673	16,729
Lead	282	2,575	377	4,384
Other metals	332	25,013	2,398	48,102
Tanning bark	190	888	414	2,264
Raw tartar	1,339	24,069	1,989	76,134
Glycerine	922	30,727	836	34,640
Wax	80	3,982	77	4.626
Rags, cotton waste	2,456	28,623	2,595	32,574
Raw hides	649	43,259	218	14,824
Sulphur	8	34	309	1,310
Glassware	510	11,057	535	16,432
Pottery, porcelain	3,959	33,072	4,138	26,144
Tartaric acid	64	37,453	49	28,665
Soap	6,634	123.279	4,945	102,856
Wax matches and candles	1,190	85,388	771	50,886
Perfumery	120	31,973	32	8.528
Drugs, medicines, &c.	1,305	46,111	265	29,196
Cigarette paper	1,295	112.117	1,773	181,301
Paper, cardboard, &c.	1,763	258,824	3,480	94701
Prepared hides	230	53,577	354	97,422

The total imports from Great Britain were, in 1897, 1,791,923*l*., and in 1898, 1,670,568*l*., and the exports to Great Britain were 96,848*l*. in 1897, and 126,320*l*. in 1898.

BRITISH INDUSTRIES AND GERMAN COMPETITION.

Foreign Office Annual Series, No. 2312, *May* 1899.

The desire to stimulate British industries by strongly emphasising German competition is perceptible and laudable, but when one hears almost exclusively of the economic progress of Germany, it has the effect of "suggestion" on the German producers; the latter will be inclined to consider themselves invincible and take it as a challenge to push forward everywhere.

The literature which has sprung up on this subject is, therefore, a two-edged sword. Its authors wish to stimulate British industry, but they exercise an influence not less animating upon German competition, as may be perceived from the various expressions of different manufacturers. If to-day the idea of a so-called "universal policy" has gained ground in Germany, and this universal policy has become popular in extensive circles from an economic point of view, the verdict of foreign countries has added to this. If it is constantly asserted that German competition is to be feared, it is evident that the German view as to its own capacity is influenced in a certain direction.

The development of prices in 1898, though not quite satisfactory, shows an improvement as against the previous year. In several industries the considerable enlargement of the factories has produced a lively demand for raw material, in consequence of which the prices for the latter were able to rise more than those for the manufactured goods. The difference between the two prices was felt very painfully by the contractors. Wages have been increased somewhat owing to lively demands here and there. Want of employment was nowhere experienced. On the contrary, complaints are raised especially as to the want of workmen in the factories and for agricultural purposes.

So far as estimates are already to hand, the dividends of industrial establishments for 1898 have for the most part increased, viz.:—

	Per Cent. 1898.	Per Cent. 1897.
Donnersmarkhutte	12	10
Upper Silesian iron industry	10	9
Oppeln cement works	12	11
Silesian zinc works	18 to 20	15
Hanover paper, Alfeld	11	7

If, in Germany, above all things, the competition of England is feared, and attempts are made to combat it by every means possible, this is the answer of their commercial achievements which speak for the energy of the trade.

GERMANY.

General Imports and Exports in Quantities for the Year 1898, *arranged according to the Classification in the German Customs Tariff.*

Foreign Office Annual Series, No. 2312, *July* 1899.

Articles.	Quantity. Imports.	Quantity. Exports.
	Metric Centners.	Metric Centners.
Lead and leaden goods	481,971	413,160
Drugs and dyes	14,125,038	7,430,114
Ores, fine metals, asbestos, &c.	61,517,412	54,817,358
Glass and glassware	141,437	1,124,426
Hides	1,367,754	461,742
Hops	23,855	74,276
Caoutchouc, guttapercha, and goods thereof.	116,266	68,574
Copper and copper goods	875,792	549,370
Leather and leather goods	130,826	173,455
Candles	1,073	6,426
Oils, not otherwise mentioned, fats.	7,733,010	1,555,193
Paper and cardboard goods	431,650	1,827,993
Petroleum	10,569,041	140,281
Soap and perfumery	13,491	75,155
Stones and earthenware	10,939,011	6,026,144
Coal, brown coal, coke, peat	147,238,976	164.825.143
Tar, pitch, resin, asphaltum	2,443,798	852,882
Oilcloth	5,036	8,836
Zinc and zinc goods	243.773	677.081
Tin and tin wares	147,165	22.451
Total of all goods, 1898	427,180,754	360,862,280
" " 1897	401,623.169	280.199.486
Increase, 1898	25,557,585	20,632,794

General Imports and Exports in Values for the Year 1898, *as compared with those of the Year* 1897, *calculated for* 1898 *according to the prices fixed for* 1897.

Articles.	Value in Thousand Marks.			
	Imports.		Exports.	
	1898.	1897.	1898.	1897.
Lead and leaden goods..	13,029	9,739	17,042	15,434
Drugs and dyes.........	233,585	233,553	355,778	329,910
Ore, fine metals, asbestos, &c.	511,061	334,680	318,712	211,931
Glass and glassware	10,489	11,245	39,127	43,516
Hides	188,925	177,201	81,796	80,928
Hops	7,443	8,334	17,901	23,876
Caoutchouc, guttapercha, and goods thereof.	57,173	49,224	37,384	36,518
Copper and copper goods	96,493	89,183	95,342	85,062
Leather and leather goods.	62,570	56,133	153,075	144,390
Candles	97	121	514	499
Oils, not otherwise mentioned, and fats.	180,784	154,458	30,344	29,431
Paper and cardboard goods.	14,709	13,418	98,195	94,991
Petroleum	65,165	62,756	1,777	1,674
Soap and perfumery	1,924	1,897	14,361	13,009
Stones and earthenware.	49,337	36,139	19,999	22,457
Coal, brown coal, coke, and peat.	124,652	127,119	192,547	174,254
Tar, pitch, resin and asphaltum.	38,221	37,975	10,089	9,282
Oilcloth	936	904	1,427	1,232
Zinc and zinc goods.....	8,752	7,888	27,227	28,249
Tin and tinware	18,659	15,840	5,378	5,006
Total of all goods	5,477,648	4,864,644	4,001,746	3,786,241
Increase, 1897...	613,004		215,505	

A comparison of the foregoing tables shows, according to the detailed German statistics, a heavier increase in British exports to Germany, than of German exports to Great Britain. It is true the values fluctuate also with the British export very materially, and in many kinds of goods the figures are at the end of the 80's or the commencement of the 90's more favourable for Great Britain than during the last few years. However, a general rise is shown in the British exports to Germany, and few categories exist which do not show an increase in 1897 as against 1896.

CHROMED LEATHER IN GERMANY.

Foreign Office Annual Series, No. 2312, *July* 1899.

Six to seven years ago German factories commenced to manufacture chevreau by the chrome process. A firm bought several patents, and sent experts to America to study the process on the spot. This factory is furnished with new American tanning machinery which is capable of turning out daily 500 dozen goatskins, and they contemplate raising the output to 1,000 dozen per day. The factory has succeeded in working off hides from various sources with like success, whereas the American factories use but one sort of skins.

TRADE BETWEEN GREAT BRITAIN AND BELGIUM.

Foreign Office Annual Series, No. 2321, *July* 1899.

Imports from Great Britain to Belgium, showing increase in 1898 over 1897 :—

Articles.	Increase.
	£
Resin, bitumen	296,480
Copper and nickel, raw, rolled, drawn, &c.	78,800
Raw minerals, under heading "Various"	65,880
Dyes and colours, not including indigo	60,120
Hops	44,160

Imports from Great Britain to Belgium, showing decrease in 1898 under 1897 :—

Articles.	Decrease.
	£
Chemical products	217,160
Yeast, leaven........................	109,080
Vegetable oils	57,080
Drugs	48,520

Exports from Belgium to Great Britain, showing increase in 1898 over 1897 :—

Articles.	Increase.
	£
Glass	195,840
Metals, unwrought zinc........................	179,600
Raw sugar........................	161,280
Minerals, various	74,680
Dyes and colours	27,960
Manure........................	26,520
Hops........................	22,040

Exports from Belgium to Great Britain, showing a decrease in 1898 under 1897 :—

Articles.	Decrease.
	£
Refined sugar	176,160
Chemical products........................	70,200
Drugs	67,760
Rags........................	51,320

SUGAR INDUSTRY IN AUSTRIA-HUNGARY.

Foreign Office Annual Series, No. 2320, *July* 1899.

During the season 1898–99 there were 214 factories in Austria-Hungary engaged in the beet-sugar industry. The total output of raw sugar during that period is estimated to amount to 1,024,000 tons, which quantity is almost equal to that produced during the season of 1894–95, when the total output reached 1,029,000 tons, the largest yet recorded. The entire area under beet cultivation in 1898–99 was 761,000 acres, whilst in 1894–95 the area was 929,000 acres. According to these figures the aggregate result in 1898–99 amounted to 27 cwt. of sugar per acre, as compared with 22 cwt. per acre in the season of 1894–95. The total quantity of beet grown in 1898–99 amounted to 7,494,000 tons, as against 8,398,000 tons in the season of 1894–95, which gives a yield of 192 cwts. per acre in 1898–99, as compared with 181 cwts. per acre in 1894–95. On the basis of the foregoing returns the total yield of sugar from the beet amounted to 13·6 per cent. in 1898–99, and 12·2 per cent. in 1894–95.

CHLORATE OF POTASH IN TURKEY.

Ch. of Com. J., Aug. 1899, 150.

The *Bulletin* of the French Chamber of Commerce at Constantinople calls attention to the fact that the entry of chlorate of potash into Turkey is severely prohibited, even when in transit only, so that the Trebizond route to Persia cannot be used. If the Customs discover this article in any consignments of mixed goods they confiscate the whole consignment, until a fine amounting to 4 fr. 25 per kilog. has been paid. This regulation does not interfere with a vessel carrying chlorate of potash for delivery in other ports, when part of her cargo has to be delivered in Turkey, inasmuch as the Customs do not board foreign vessels, but confine their examination to goods actually landed.

GERMANY'S BEET-SUGAR INDUSTRY FROM 1877 TO 1899.

U.S. Cons. Reps., July 1899, 471.

The United States Consul at Magdeburg has compiled from the most recent and reliable sources all the statistical material bearing on the beet-sugar industry in Germany during the past 20 years. As will be seen, the data have been grouped under three heads:—

(*a*.) Those relating to work done in the sugar-beet fields.

(*b*.) Those relating to work done in the beet-sugar factories.

(*c*.) Those relating to the marketing and consumption of beet-sugar.

The unit of weight used in these tables is the metric ton, of 1,000 kilograms (2,204·6 pounds).

A.—*Sugar Beet Farming.*

Year.	Area Cultivated.	Beets Harvested per Acre.	Value of Beets per Acre.	Average Prices of Beets per Ton.
	Acres.	Tons.		
1878-79	266,075	11·696	62·48	5·00
1883-84	317,924	12·100	63·83	5·30
1888-89	691,897	11·412	54·78	4·30
1893-94	954,995	11·125	55·65	5·00
1897-98	1,079,810	8·619	50·48	4·00
1898-99	1,054,229	11·519	..	..

B.—*Beet-Sugar Manufacturing.*

Year.	Number of Factories Operated.	Number of Steam Engines.	Number of Horse-Power.	Beets Worked.	Total Production of Raw Sugar.	Total Production of Molasses.	Average Production per Factory.	Raw Sugar from 1 Ton of Beets.	Beets required for 1 Ton of Raw Sugar.	Sugar in the Beet.	Number of 12-Hour Work-days.	Beets Worked in one 12-Hour Work-day.	Number of Sugar Refineries.	Total Production in Raw, including that from Molasses.
				Tons.	Tons.	Tons.	Tons.	Lb.	Tons.	Per Cent.		Tons.		Tons.
1878-79	324	2,493	26,882	4,628,748	426,155	133,652	1,315	203·04	10·86	9·21	75,895	61	63	430,684
1883-84	376	3,715	46,158	8,918,130	940,109	207,978	2,500	232·36	9·49	10·54	89,956	99·1	57	936,403
1888-89	396	4,363	60,313	7,896,183	944,505	201,189	2,385	263·67	8·36	11·96	66,727	118·3	46	990,891
1893-94	405	5,256	87,421	10,644,352	1,316,665	279,299	3,251	272·47	8·10	12·34	63,294	168·2	57	1,366,001
1897-98	402	5,563	114,211	13,697,892	1,755,229	344,480	4,366	281·97	7·8	12·79	63,442	215·9	50	1,844,400
1898-99	401	..	..	12,144,291	1,710,000	..	4,264	310·42	7·1	13·15	..	..	54	1,725,000

C.—*Beet-Sugar Marketing and Consumption.*

Year.	Total Export of Raw Sugar.	Export to United States.	Total to Great Britain.	Total Import of Raw Sugar.	Total Import of Refined Sugar.	Total Consumption.	Consumption per Capita.	Mean Prices per lb.		Total Proceeds from Taxes, Duties, &c.				Per Capita.
										Receipts from		Export Bounties Paid.	Total Net Proceeds.	
								Raw Sugar.	Refined Sugar.	Taxes.	Duties.			
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Lb.	Cents.	Cents.					Cents.
1878-79	137,250	..	..	1,530	3,902	296,049	14·77	6·1	8·37	17,626,273	502,840	6,035,673	12,093,200	27·6
1883-84	594,702	..	..	1,876	1,558	349,671	16·975	5·66	7·66	35,529,449	333,317	22,919,925	11,373,619	24·99
1888-89	610,207	..	..	2,016	1,908	357,614	15·653	3·78	6·21	25,869,172	351,526	19,058,088	7,162,610	14·76
1893-94	721,153	115,698	529,520	600	448	516,630	24·69	2·72	5·72	22,185,646	98,770	2,713,438	19,576,978	38·08
1897-98	1,033,262	142,907	666,263	513	707	803,897	28·814	2·18	5·04	32,626,230	105,910	8,724,842	24,007,298	44·26
1898-99	..	..	..	..	..	..	..	2·25	5·13	..	..	..	..	..

Germany must find an outside market for two-thirds of her production, most of which for the past five years has been sold to England and the United States. In 1897 more than double the usual quantity was rushed to the United States in anticipation of the enactment of the Dingley law, but the following year (1898) showed again a fair average of export. The first three months of the present calendar year seem to furnish no reason for complaint to the German exporter of sugar. From January 1 to March 31, 1899, the values of sugar declared at the United States consulates at Magdeburg, Hamburg, Danzig, and Stettin for export to the United States amounted to 3,739,934·06 dols., which is an increase of 3,155,695·29 dols. over those reported during the first quarter of last year.

A short table showing exports of German sugar from the consular district of Magdeburg during the past four years is added:—

Beet-Sugar Exported from Magdeburg to the United States.

Calendar Year.	Raw Sugar.	Refined Sugar.
	Dols.	Dols.
1895	943,123·84	133,967·75
1896	4,302,535·60	610,960·46
1897	5,973,290·29	329,379·58
1898	4,735,957·82	32,930·38

Consumption of Beet Sugar in Germany.

U.S. Cons. Reps., Aug. 1899, 655.

It seems to be generally admitted that German beet sugar, when once it comes into competition with the Cuban product, must go to the wall. In casting about for some way of saving the industry from utter destruction, many plans have been proposed, but the most available seems to be to "increase home consumption." To this end, it is proposed to issue sugar as a ration to the soldiers and to encourage farmers to feed it to stock, especially to hogs. Of course, this will necessitate the cheapening of the article, and the only way this can be effectually accomplished

Country.	Population.	Sugar used per Capita per Annum.
		Lb.
England	39,972,000	91·31
Switzerland	2,990,000	52·11
Denmark	3,340,000	48·83
Sweden and Norway	7,031,000	40·74
Holland	4,938,000	34·41
France	38,539,000	31·02
Germany	54,168,000	30·22
Belgium	6,495,000	23·08
Austria	45,391,000	17·84
Portugal	5,105,000	14·24
Russia	106,250,000	12·61
Spain	17,913,000	8·09
Roumania	5,505,000	7·21
Turkey	24,082,000	7·08
Italy	31,300,000	6·28
Greece	2,433,000	6·24
Bulgaria	3,312,000	5·53
Servia	2,345,000	4·72
All Europe	400,109,000	25·42
United States	72,807,000	59·30

is to abolish the taxes now paid on sugar consumed in Germany, and reduce or entirely discontinue sugar bounties.

The statistics of the consumption of sugar in Europe and America, given on the preceding page, and taken from the last monthly report of Herr Licht, statistician of the beet-sugar industry of the German Empire, show conclusively that there is ample room for a large increase of its use in Germany.

SUGAR IN SPAIN.

U.S. Cons. Reps., Aug. 1899, 744.

Mr. Mertens, in charge of the consular agency at Valencia, under date of June 5, 1899, says:—

Since the loss of her colonies, Spain's sugar factories, with a yearly production of about 60,000 tons, are unable to satisfy the public demand, which amounts in all Spain to about 100,000 tons of sugar during the year. A high prohibitive duty of $102\frac{1}{4}$ per cent on foreign sugar protects the home industry and stands in the way of sugar dealers and consumers. For this reason, a union of tradespeople and merchants of the different cities of Spain have petitioned the Spanish Government to reduce the import duty to 50 per cent., which would afford a fair protection for the refineries and at the same time permit the import of sufficient sugar to supply the demand. While this petition meets with great opposition from the refiners, still, in view of the need of sugar and the small chance of increasing either the number of factories or their output in the near future, the Spanish Government will probably reduce the duty, more especially as this will add to the customs income of the country and do away with the incentive for smuggling. As soon as this reduction becomes a law, our dealers in refined sugar should be ready with samples to secure contracts, before the competition with other countries becomes too keen.

SUGAR AND SPIRIT RINGS IN GERMANY.

Foreign Office Annual Series, No. 2312, *July* 1899.

Among the syndicates about to be formed the sugar and spirit rings deserve attention from an economic point of view. Both are intended to represent the interests of the manufacture on the basis of, or as supplementary to, the existing markets. The export of German sugar to England is very considerable, and the attempted sugar ring has therefore a significance for England, although it is doubtful whether the union will be strong enough to influence the price of sugar on the world's market. Very likely the effect of the ring will be that the price for refined sugar will be advanced in Germany itself, and that refiners and raw sugar manufacturers will then, on the basis of the world's market, divide the surplus obtained.

The spirit ring is to control the sale of the home market, because the spirit export, with which formerly Germany ruled the world's market, has been from year to year decreasing in importance. The spirit distillers assert that the character of their trade, as a season trade, is one which demands that the spirit be placed on the market in great quantities during the season, and that these quantities again are the means of reducing the price. As soon as the season is at a close the price begins to rise, but this advance in price is of no use to the distillers, it only benefits the trade. The ring, the founding of which meets with great difficulties, proposes to regulate the demand so as to distribute it over the entire year. Hereby a question turns up which is of great importance for Germany, *viz.*, the use of alcohol for technical purposes. The enormous increase in the price of alcohol makes increase in the consumption almost impossible. The future of the German liquor trade therefore rests on extending the use for technical purposes.

The expected competition against petroleum will be realised, but with great difficulty, inasmuch as although good spirit lamps exist, the price for spirit in comparison to petroleum is still much too high. It will probably still be a long time before the home potato will provide the peasantry with light. On the other hand, the consumption of spirit for burning purposes has increased, and has also been furthered by measures taken by the Government.

FOREIGN AND HOME CONSUMPTION OF GERMAN BEER.

U.S. Cons. Reps., Aug. 1899, 653.

The German beer industry has grown year by year, and the increasing capacity of the establishments has made it necessary for the brewers to search for new markets where their over-production could be disposed of. The home consumption, of course, is depended on as giving the first and greatest chance to sell the different kinds of beer, but the larger brewers have had to find customers in foreign countries. Their efforts for some time met with good results, and Germany's beer industry had an export market for its products which seemed to be all that could be expected.

In the year 1885, the export of German beer reached its high-water mark, amounting in that year to 1,318,000 hectolitres (34,828,560 gallons), representing a value of 24,000,000 marks. The next year, however, showed a decrease, and since then the export has gone down to about one-half of what it was in 1885. The reason given for this decline is that the countries which were Germany's best customers (France, Belgium, and the Netherlands) have increased their output sufficiently to nearly meet the home demand. The high duty placed on foreign beers by France has also had the effect of considerably reducing the import of German beers into that country.

In all those years, the export of German beer in barrels has been greater, contrary to general belief, than in bottles.

German beer once had nearly a monopoly of the beer trade of South America, but there also, it is stated, the demand has decreased, while at the same time, according to trade papers, the demand for United States beer has increased. The decline of the German beer trade in Brazil alone during the years 1896 and 1897 is given as amounting to fully three-fourths of what the German brewers had exported to that country in former years.

It is a noticeable fact that, while the export has declined year by year, the production of beer in Germany has advanced steadily, showing that the home consumption has greatly increased. At present, the United States is the best foreign customer for German beer, importing 522,138 galls. in 1895 and 689,456 galls. in 1896. The export of beer from Germany to Venezuela, Japan, and China together did not in the years given amount to one-half the exports to the United States alone. Brazil and British India, as consumers of German beer, come next to the United States.

The German brewing industry has strong hopes of entirely supplanting the English in Australia and other English colonies.

GERMAN EXPORTS IN 1897 AND 1898.

U.S. Cons. Reps., Aug. 1899, 655.

The following are the latest statistics of German exports of manufactures:—

Articles.	1897.	1898.	First Quarter of 1898.	First Quarter of 1899.
	Dols.	Dols.	Dols.	Dols.
Coal	41,500,000	44,800,000	11,500,000	11,700,000
Colours, drugs, &c.	76,200,000	84,700,000	19,400,000	20,100,000
Copper and copper goods.	20,400,000	22,700,000	5,300,000	6,000,000
Caoutchouc goods	8,800,000	8,900,000	3,400,000	3,800,000
Glass and glassware	10,400,000	9,300,000	2,100,000	2,500,000
Leather and leather goods.	34,400,000	36,400,000	8,400,000	9,500,000

WATER FILTERS FOR CHINA.

U.S. Cons. Reps., Aug. 1899, 752.

When in Port Arthur last November, Consul Fowler noticed the soldiers drinking out of large jars, or kongs, water which was unfiltered and certainly dangerous. It occurred to him that if American manufacturers could sell a good cheap filter, or, better still, small condensers for condensing either fresh or salt water, an immense market would be opened to them, not only among the Russian troops, but among the British at Weihaiwei and the Germans at Kyaochau, not to mention foreigners and even Chinese elsewhere in this Empire, who now depend upon muddy river or rain water for all purposes.

British Soap Works in Germany.

Foreign Office Annual Series, No. 2312, *July* 1899.

The soap manufacturers, Lever Brothers, of Port Sunlight, near Liverpool, acquired at the end of the past year in a newly-opened section near the harbour of Mannheim, an area covering about 85,000 square metres for the price of about 425,000 marks, in order to establish there a large factory for their specialities like the soap factory "Helvetia," opened at Olten, in Switzerland. The undertaking is of importance to the industrial rise of Mannheim, the greatest inland harbour on the Continent. It is worth remarking, however, to illustrate the feeling of Germany at large, that the Baden soap manufacturers at once forwarded a petition to the Diet asking for Government measures to be taken against the invasion of the Sunlight Soap Company. The petitioners speak of the "great concern" and fear ruin on account of this British competition. It is needless to say that the laws of the country offer no ground to interpose in the manner desired by this petition. But it must be remarked in this connection that the German press always shows the greatest pleasure at the progress of German enterprise in foreign countries, but when an English enterprise is forced to open a branch in Germany, owing to the German customs laws, these newspapers are anything but pleased.

The Manjak Industry in Barbadoes.

Bd. of Trade J., Aug. 1899, 147.

The origin of the term "manjak" is unknown (see this Journal, 1897, 429 and 1899, 738). It varies in quality, being sold locally at prices varying from 7*l.* 10*s.* to 3*s.* 10*s.* per ton. The mine producing what is known as Merivale's manjak yields the best quality produced in the island. In 1897 it paid over 50*l.* a week in wages, and employed over 100 hands.

The veins of the material vary in width from a few inches to many feet, pinching and widening capriciously. They run through walls of infusorial earth, locally known as chalk, and through a species of blue clay like diamondiferous blue, but of a somewhat softer character. For the most part it has been found and worked on the eastern side of the island. Although discovered in many places, it has not yet been found in great quantity, but its quality is such as to make it a profitable industry.

The export has risen from 878 tons in 1896 to 1,880 tons in 1897, and with further discoveries, might make its way as an important item of export.

Wheat for Alimentary Pastes in France.

U.S. Cons. Reps., July 1899, 468.

In several European Countries, the different forms of edible pastes known as macaroni, spaghetti, vermicelli, nouilles, etc., are produced in very large quantities. From a small and somewhat local business it has become a large, prosperous, and constantly increasing industry, upon which millions of people depend for their food. At Marseilles, the different branches of the industry were specialized. There the selection, purchase, and preparation of the proper kind of wheat for paste making became a separate branch of commerce and manufacture. Certain men made a business of buying the wheat, of grinding it into the sort of "grists" or "semoule" which is used for making edible pastes, and of selling the semoule to the paste makers and the byproducts of the wheat to other customers. There are now importers and brokers in these special kinds of wheat, grinders of the simoule, and a class that sells the simoule to paste makers. It has thus become easy for manufacturers to obtain the precise quality of wheat desired for the different pastes. A number of establishments are constantly employed in making large hydraulic presses for the production of these pastes, and the industry is carried on extensively in France, Italy, Germany, Switzerland, and some other countries.

It is estimated that the French output of these pastes is from 120,000,000 to 170,000,000 pounds per annum, and this product is unquestionably destined to increase greatly. What is wanted is a hard wheat, containing a large percentage of gluten and a relatively small percentage of starch. American wheat is lacking in both these desiderata. But all gluten is not alike. It is said that the excellence of the gluten depends upon the relative quantities of gliadin and glutenin contained in it. The wheat which is now considered the best is that grown in the neighbourhood of Taganrog, Russia; the next is from Algeria. That produced in southern Italy, where the manufacture of pastes originated, has lost the high place it formerly held. The best wheat grown in France—considered better than the American product—is from the neighbourhood of Clermont-Ferrand.

Rapidity of growth and ripening is considered of prime importance in the production of the desired qualities in the wheat. These are the chief factors in the Taganrog product.

Millers and bakers in France have found that bread is improved by putting into a larger amount of gluten than is found in French or American wheats, and as a consequence very hard wheats—the Taganrog, generally—are mixed with the others. These wheats cannot be raised in France, but must be imported, and they are the only kinds which are always sure to find a market in that country.

Natural *v.* Artificial Indigo in the East.

U.S. Cons. Reps., July 1899, 408.

The U.S. Consul at Batavia encloses an article clipped from a Singapore paper, from which it appears that the production of natural indigo is seriously threatened by artificial indigo manufactured from coal-tar products. But the Consul considers that although the situation may be desperate as regards British India and the Straits, the indigo industry has been holding its own very well in Java and that until the outlook becomes very much more unpromising and a better paying industry offers itself, indigo will continue to be raised on this island.

The Consul has been unsuccessful in procuring figures of the profits or losses in planting; but those planters with whom he has talked, allowing for the natural discontent peculiar to those engaged in agricultural pursuits the world over, do not appear to be unduly dissatisfied, and last year's prices were no less than usual.

The total indigo produced in Java in 1896 (figures for 1897 and 1898 not yet out) was 723,823 kilos. (1,592,410 lb.), on 144 plantations.

Year.	Imports (from Straits Settlements only).		Exports (none to the United States).	
	Kilos.	Lb.	Kilos.	Lb.
1895	23,540	51,788	879,904	1,935,788
1896	36,121	79,466	824,550	1,814,010
1897	32,701	71,942	1,091,383	2,401,042

Three-fourths of the exports went to Holland. The exports for 1898 show a decided increase over those of 1897.

Copper in the Urals.

U.S. Cons. Reps., July 1899, 453.

The U.S. Consul at St. Petersburg quotes from an article in the *Commercial Gazette* as follows:—

Latterly, the demands for copper mines have increased, owing to the rise of prices of copper. This is unexpected, as but five years ago, copper-smelting factories gave up their mines to the Government. The copper industry has declined in the Urals; but should copper speculations continue abroad, the revival of the industry in Russia may be expected. In some of the factories in Tagill, a ton of copper is sold at 180·50 dols., whereas two years ago it was sold at 298 dols. to 372 dols. per ton. Chemical factories in the district of Elabuga have great demands for copper, and new mines in the government of Viatka have been discovered. This government was formerly one of the first in the smelting of copper, but now only the peasants, when they are free from other work, extract the ore and take it to Kukmor and other villages, where it is smelted in ordinary smithies and made into cheap articles. However, there are two or three workshops which make larger articles and even samovars.

AUSTRIA-HUNGARY.

Table showing Articles Imported into Austria-Hungary from Great Britain during the Years 1897–98.

Foreign Office Annual Series, No. 2320, *July* 1899.

Articles.*	Value.		
	1897.	1898.	Difference.
	£	£	£
Sugar	3,932	2,852	− 1,080
Grease and tallow	99,976	57,752	− 42,224
Oils	69,399	38,182	− 31,217
Beer	344	491	+ 147
Coal and coke	102,177	108,913	+ 6,736
Minerals	11,236	14,888	+ 3,652
Medicine and perfumery	3,878	2,154	− 1,724
Dyeing and tanning materials	60,682	36,529	− 24,153
Gums and resins	40,612	40,660	+ 48
Mineral oil	289	439	+ 150
Paper and paper goods	13,832	13,801	− 31
Indiarubber and indiarubber goods.	262,527	236,392	+ 33,865
Oilcloth and linoleum	11,285	9,882	− 1,403
Leather and leather goods	511,354	507,373	− 3,981
Glass and glassware	1,709	2,929	+ 1,220
Stoneware	39,158	42,241	+ 3,083
Earthenware	11,027	15,136	+ 4,109
Chemical substances	127,820	107,137	− 20,683
,, produce	55,784	52,669	− 3,115
Soap and candles	1,578	1,830	+ 252
Matches and gunpowder	796	1,236	+ 440
Refuse, manure, rags, &c.	2,710	3,269	+ 559
Total of all articles	5,732,398	5,579,935	− 152,463

Table showing Articles Exported from Austria-Hungary to Great Britain during the Years 1897–98.

Foreign Office Annual Series, No. 2320, *July* 1899.

Articles.	Value.		
	1897.	1898.	Difference.
	£	£	£
Sugar:—			
Refined sugar (no bounty)	6	7	+ 1
Sugar, 1st class (bounty 1 fl. 50 c.).	59,810	46,965	− 12,844
Sugar. 2nd class (bounty 1 fl. 60 c.).	236,462	173,479	− 62,983
Sugar, 3rd class (bounty 2 fl. 30 c.).	2,779,078	2,388,583	− 390,495
Grease	1,915	1,163	− 752
Oil	1,791	15	− 1,776
Beer, wine, &c.	3,704	4,267	+ 563
Mineral water	20,028	25,848	+ 5,820
Coal	38	142	+ 104
Minerals	2,787	4,002	+ 1,215
Medicines and perfumery	170	92	− 78
Dyeing and tanning materials.	60,489	79,470	+ 18,981
Gums and resins	6,253	6,604	+ 351
Mineral oil	1,225	3	− 1,222
Paper and paper goods	71,088	79,494	+ 8,406
India rubber and india-rubber goods.	10,349	8,957	− 1,392
Leather and leather goods	1,237,673	924,277	− 313,396
Glass and glassware	251,836	265,771	+ 13,935
Stoneware	687	1,973	+ 1,286
Earthenware	36,427	42,334	+ 5,907
Chemical substances	14,118	14,204	+ 86
.. produce	46,657	56,531	+ 9,874
Soap and candles	124	106	− 18
Matches and fusees	201	298	+ 97
Refuse, manure, rags, &c.	12,399	2,922	− 9,477
Oilcloth and linoleum	..	537	+ 537
Total of all articles	6,667,811	6,074,861	− 592,950

TARIFF CHANGES AND CUSTOMS REGULATIONS.

RUSSIA.

Duties on Salts of Gold and Silver.

Article 110 of the general tariff for European trade has been revised as follows:—

Salts of gold, silver, and platinum.

1. Salts of gold (including gold purple), salts of platinum and of platinised metals, Rs. 12 per poud.

2. Salts of silver of all kinds, Rs. 100 per poud.

GENERAL TRADE NOTES.

SICILIAN SULPHUR.

Chem. and Druggist, Aug. 12, 1899, 306.

The exportation from Messina during the first half of the present year amounted to 269,454 tons, against 284,570 tons during the same period of last year, or a falling off of 16,216 tons. Stock on July 1 amounted to 2,720,992 cantars (209,307 tons), against 1,616,760 cantars (124,366 tons) last year, or an excess of 1,104,232 cantars. Notwithstanding this, prices have remained stationary in Sicily, with a rather firmer tendency, and for finer qualities especially, business has been difficult, because the principal holders are not ready sellers, and are asking higher prices. They are also buying from outside producers, in order to sustain the market. Sulphur from "outside" mines can be bought cheaper, but large parcels cannot be obtained. The syndicate has cancelled its contract with the refiners and millers of Catania, which are now free. However, the syndicate, in spite of the heavy stocks it holds at Catania both of refined, sublimed, and ground sulphurs, has already entered into competition with the millers, by buying from the outsiders the sulphur coming to Catania for sale evidently with the object of maintaining present prices.

THE JAPANESE CAMPHOR MONOPOLY.

Chem. and Druggist, Aug. 12, 1899, 306.

Serious difficulties have arisen over the camphor monopoly in Formosa. In official circles of the Government, anxieties are entertained with regard to the enforcement of the law which necessitates a reduction in the number of manufacturing pans to one-third, as this will doubtless cause open rebellion on the part of the natives. As is well known, the finances of this industry are largely in the hands of foreign residents and European capitalists, and it is said that when the law is enforced, these foreigners will no doubt assist the natives to rebel against the monopoly. The Government is, therefore, considering how it shall recompense the natives for their loss of employment, and it is suggested that employment should be found for them as coolies, in constructing railways in the island. In connection with the above, *Commercial Intelligence* has the following:—"The *Fiji*, a Japanese paper, says that serious evils have arisen in connection with the camphor monopoly. Those who have obtained licences to manufacture camphor, but have not yet fixed their apparatus, have commenced operations in the camphor forests, while many Japanese and Formosans are alleged to be engaged in secret manufacture, with the result of irregular cutting of camphor trees, and the production of camphor of an inferior quality."

THE CHEMICAL TRADE OF HAMBURG.

Chem. Trade J., Aug. 5, 1899, 85.

British Imports and Exports.—The more important articles of import from the United Kingdom which increased last year were the following, *viz.*:—Chemical products, copper, yellow metal, tin, train oil, paper, and stoneware.

On the other hand there was a falling-off last year in the importations of the following articles, *viz.*:—Coal, indigo, varnish, sulphate of ammonia, oils, and india-rubber goods.

The export trade of Hamburg to the United Kingdom in 1898 was as follows:—

——	Quantity.	Value.
	Cwts.	£
1896	17,275,522	19,140,791
1897	18,000,298	18,816,707
1898	20,429,238	19,262,184

Sugar, potato flour, and starch, aniline dyes, nitrate, india-rubber manufactures, palm oil, paper, porcelain increased last year.

Chemical products, copper, tin, hides and skins, leather, rags, paper, glass decreased.

Tallow.—The quantities of tallow in this and other European markets have declined, so that higher prices in this article may be looked forward to in a near future, especially as the quotations for other products which are used for the same purposes as tallow appear likely to remain at their present rates.

Resin.—The importations of American resin amounted to 161,040 barrels, as against 157,330 barrels in 1897; and those of French resin at 6,781 barrels, the same quantity as in 1897.

Turpentine.—67,597 barrels of American and 898 barrels of French, Spanish, and Portuguese turpentine were imported to Hamburg last year, as against 47,024 and 527 barrels respectively in 1897. Prices experienced a gradual advance last year, in view of the general increase in demand from most countries.

Dyewoods.—Trade in nearly all kinds of dyewoods in 1898 was very quiet; the prices of some kinds experienced considerable fluctuations. Of Campeachy logwood only 13,700 tons were imported, as against 17,800 tons in the preceding year; of Jamaica and San Domingo logwood, 8,100 tons, as against 8,750 tons in 1897; of Lima redwood, however, the importations amounted to 550 tons, as against 290 tons in 1897.

Indigo. — The prices of indigo experienced a gradual decline in 1898; and, apace with this decline, the consumption increased, so that the large stocks were in course of time much reduced. The opinion is rapidly gaining ground now, that indigo is not merely a very cheap article, but also well able to compete with the prices of all other dyes substituted for it; so that it may be said that confidence in this article is now again returning. The unfavourable effects of three over-abundant crops (1894, 1895, and 1896) have thus now been overcome; and the prospects of a crop of average quantity and excellent quality render it likely that, under these conditions, business in indigo in 1899 will develop in a normal, healthy manner.

Sodium Nitrate.—Whilst the total importations of nitrate to Continental Europe and also to the United Kingdom amounted in 1898 to about 1,038,000 tons, and thus showed an increase over those during 1897 of about 120,000 tons, the importations to Hamburg alone experienced a decrease, *viz.*, from 436,500 tons in 1897 to 374,900 tons last year. The reason of this falling off is stated to have been that large quantities of nitrate had been held in stock in German inland markets during the last season. It would seem, however, that these large stocks must have been used up before the end of the year, even with further imports; for towards December the demands arising in Hamburg from the interior could not, in some instances, be met. At the close of 1898 the total stocks held here were only 17,000 tons, as against 74,100 tons at the end of 1897. It is thought here, that if the quantities of nitrate on their way to Europe during the last few months, which are estimated at about 563,000 tons, should be detained by adverse weather, an unlooked-for state of things is likely to arise for the nitrate market.

Glass Manufacture.—The German glass industry—including that in this district—is reported to have done a good business in 1898, in spite of a general fall in prices.

Lubeck.

Tar was less produced in Finland on account of the high price of wood, so that in the course of the winter and spring it continually mounted in price. Although the import increased in the summer the high prices were still kept up.

The article advanced continually in price, that is to say, 4*s.* to 5*s.* per barrel for Finland tar, in the course of the year. Quotations at the beginning of the year amounted to 20*s.* to 21*s.* per barrel.

The imports of 1898 consisted chiefly of tar from the ports of Finland. In addition, there were 1,100 barrels from Archangel, about 90 barrels and 800 half-barrels from Haparanda, as well as a small quantity from Sundsvall and other Baltic ports.

Pitch.—The prices, in conformity with those of tar, advanced during the whole year, but to a still greater extent, so that the increase at the end of 1898, compared to 1897, for Finland pitch amounted to 6*s.* to 7*s.* per barrel; prices at beginning of 1898, 26*s.* to 27*s.* per barrel. Lubeck's returns fortunately somewhat increased.

Harburg.

Linseed Meal.—The linseed factories are fully employed. The increased demand for the produce in the English and Scotch markets is attributed to the richness of oil the cake contains.

Heavy imports of *resin* are chronicled to meet the demand. Harburg is the great centre for this trade in Germany, Total shipments were 101,862 tons.

The *india-rubber* factory, Harburg and Vienna, also records a satisfactory year. The dividend distributed was about 29 per cent. A new feature in this trade is the starting of a special department for the manufacture of tyres.

Of *bone ash*, a few cargoes reached Harburg, totalling 2,450 tons.

The trade in *China clay* has undergone no alteration. The imports amounted to 15,497 tons.

General Chemicals. — The following were the chief imports, in addition to the foregoing:—Phosphates, 5,627 tons; sulphur ore, 9,400 tons; manure, 703 tons; slags, 2,088 tons; tar, 2,184 tons; and pitch, 1,099 tons.

Bremen.

British Trade.—The chief imports from the United Kingdom into Bremen during 1898 were:—Drugs and chemicals, 3,208,321 marks; india-rubber, 2,541,710 marks; and oils, 200,778 marks. The exports were:—Dry colours, 381,460 marks; starch, 1,184,711 marks; oil cakes, 1,520,070 marks. Among the totals for all countries we find cement, about 56,700 tons imported and 32,142 tons exported. Manure, 78,479 tons imported and 78,243 exported.

IRON ORE IN KENT.

E. Riley. Daily Chronicle, Aug. 9, 1899.

With reference to the 12-ft. seam of iron ore which was recently discovered at the Kent Colliery Works at Dover, at a depth of between 500 ft. and 600 ft., an official report has been supplied by Edward Riley. The results are regarded as highly satisfactory.

E. Riley says, the maximum metallic iron contained in the Dover bed is 42 per cent., and the minimum 32 per cent. Smelting on the spot with the company's own fuel would make it possible to work the whole of the bed at a profit. As to raising the ore and selling it for smelting elsewhere, he suggests that the Cleveland district is the most likely market on account of the advantageous freights which could be obtained with the large number of coal steamers that usually return in ballast from the Thames and southern ports to the Tyne and Wear districts. If for the present the lower 6 ft. only of the 12-ft. seam be worked, this area will give an ore averaging 38 per cent. of iron, and 12 per cent. of silica in the raw state. Based on the present prices of Cleveland ore, he says that this should be worth 7*s.* 6*d.* a ton delivered in the Tees. Putting the cost of working at what he considers the high average figure of 3*s.* 6*d.* a ton, shipping charges at 4*d.*, and freight at 2*s.*, a profit of 1*s.* 8*d.* a ton is left.

UNITED STATES TRADE.

Chem. and Druggist, Aug. 19, 1899, 385.

The completion of the year's statistics of imports and exports has enabled the Treasury Bureau of Statistics to present a statement of imports of all articles whose value in the fiscal year 1898–99 exceeded 1,000,000 dols., comparing the same with the imports of 1898 and 1897. In this statement appears the following:—

Articles Imported.	1896–97.	1897–98.	1898–99.
Chemicals	44,948,752	41,470,773	42,668,731
Rubber, crude	17,558,163	25,545,391	31,876,242
Lead and manufactures of	1,948,225	2,600,779	2,784,611
Spices	2,576,717	2,404,629	2,782,281
Fertilisers	1,111,512	1,370,533	1,492,019
Platinum	1,049,780	1,032,192	1,193,475
Plumbago	321,355	472,401	1,081,859

The figures represent dollars.

The increase in the importation of fertilisers gives a point to English manufacturers.

PRODUCTION OF ORES AND MINERALS IN THE UNITED STATES. (FIRST PRODUCTS.)

"Mineral Industry," Vol. VII., through Eng. and Mining J., July 29, 1899.

No.	Products.	Customary Measures.	1897.				1898.			
			Quantity.		Value at Place of Production. *a*		Quantity.		Value at Place of Production. *a*	
			Customary Measures.	Metric Tons.	Totals.	Per Metric Ton.	Customary Measures.	Metric Tons.	Totals.	Per Metric Ton.
					Dols.	Dols.			Dols.	Dols.
1	Asbestos	Sh. T.	840	762	12,950	16·99	885	803	13,425	16·72
2	Asphaltum	„	27,397	24,854	486,620	19·58	25,690	23,306	482,175	20·69
3	Asphaltic limestone	„	2,390	2,168	11,450	5·28	14,099	12,791	70,495	5·51
4	Bitumin's sandstone	„	47,470	43,065	136,173	3·16	49,536	44,938	146,275	3·26
5	Barytes	„	26,430	23,977	105,720	4·41	28,247	25,626	112,988	4.41
6	Bauxite	L. T.	20,590	20,919	51,475	2 46	26,791	27,220	66,978	2·46
7	Borate of calcium (*c*)	Sh. T.	19,400	17,600	388,000	*n*22·05	15,335	13,911	306,700	*n*22·05
8	Bromine	Lbs.	487,149	221	136,402	617·19	486,978	221	136,354	617·19
9	Cement, nat. hydraul.	Bbls. *g*	7,890,573	1,073,742	3,976,050	3·70	8,161,078	1,110,552	3,319,995	3·44
10	Cement, Portland	„ *h*	2,430,903	441,060	3,724,905	8·45	3,584,586	650,383	6,168,106	9·48
11	Chrome ore	L. T.	150	152	1,550	10·17	100	102	1,000	9·84
12	Clay products	..	..	..	56,487,527	..	..	..	58,470,543	..
13	Coal, anthracite	Sh. T.	52,645,133	47,759,351	85,857,717	1·80	52,848,605	47,943,940	81,445,937	1·70
14	Coal, bituminous	„	148,155,567	134,405,849	120,013,372	0·89	165,208,025	149,875,737	128,419,354	0·86
15	Coal, cannel	„	56,511	51,266	153,145	2·99	49,889	45,259	134,700	2·98
16	Cobalt oxide	Lbs.	19,300	*k* 8,754	30,880	*k*3·53	9,640	*k* 4,373	15,424	*k* 3·53
17	Copper sulphate (*f*)	„	16,731,247	7,599	645,826	*m*85·10	28,061,501	12,729	956,897	*m*75·18
18	Corundum	Sh. T.	293	266	19,810	74·47	786	713	63,630	89·24
19	Emery	„	1,900	1,724	92,000	53·36	2,956	2,682	143,800	53·62
20	Feldspar	L. T.	21,901	22,251	111,392	5·01	21,350	21,692	107,147	4·94
21	Fluorspar	Sh. T.	4,739	4,299	36,264	8·44	12,145	11,018	86,985	7·89
22	Fullers earth	„	17,195	15,599	92,398	5·92	15,553	14,110	87,365	6·19
23	Garnet	„	2,261	2,051	66,353	32·35	2,882	2,615	82,930	31·71
24	Grahamite	„	1,756	1,593	52,680	*n*33·07	2,675	2,427	80,250	*n*33·07
25	Graphite, crystalline	Lbs.	993,138	*k* 450,484	*m* 44 691	*k* 0·10	1,647,679	*k* 747,382	*m* 148,291	*k* 0·20
26	Graphite, amorphous	Sh. T	1,200	1,089	11,400	10·47	1,200	1,089	11,400	10·47
27	Gypsum	„	300,369	272,493	889,177	3·26	348,686	316,326	989,589	3·13
28	Iron ore	L. T.	18,235,406	18,527,772	30,941,379	1·67	20,655,865	20,986,359	37,593,674	1·79
29	Magnesite	Sh. T.	*c* 1,907	1,730	*c* 7,628	4·41	*c* 2,355	2,136	*c* 9,429	4·41
30	Manganese ore (*i*)	L. T.	158,050	161,147	328,176	2·04	217,782	221,279	481,127	2·17
31	Mica, scrap	Sh. T.	2,882	2,615	*o* 28,820	11·02	3,529	3,201	*o* 39,837	12·44
32	Mica, sheet	Lbs.	118,852	*k* 53,911	83,298	*k* 1·55	109,968	*k* 49,881	91,462	*k*1·83
33	Molybdenite	Sh. T.	Nil.	Nil.	Nil.	Nil.	8	7	400	57·14
34	Monazite	Lbs.	40,000	18	2,000	110·23	*d* 150,000	68	*c* 7,500	110·23
35	Natural gas	..	..	..	*e*10,000,000	..	..	..	*e*10,500,000	..
36	Ochre (*p*)	Sh. T.	42,590	38,637	468,490	*n* 12·13	41,950	38,057	461,450	*n*12·13
37	Petroleum, crude	Bbls *y*	57,124,783	7,992,046	39,372,111	4·93	51,774,465	7,243,509	42,100,522	5·81
38	Phosphate rock	L. T.	1,007,367	1,023,485	3,022,101	2·95	1,257,645	1,277,717	4,355,025	3·41
39	Precious stones	..	..	..	*d* 101,000	..	..	..	*e* 125,000	..
40	Pyrites	L. T.	133,368	135,502	404,699	2·99	191,160	194,219	589,329	3·03
41	Salt (*q*)	Barrels	15,822,923	2,009,625	3,898,556	1·94	18,756,394	2,382,197	4,753,664	2·00
42	Silica, brick	M.	20,233	..	323,561	..	33,449	..	590,254	..
43	Diatom. earth	Sh. T.	3,000	2,722	30,400	11·17	1,392	1,263	11,002	8·71
44	Flint	„	28,407	25,771	55,817	2·17	35,593	32,290	73,313	2·27
45	Sand, &c.	L. T.	*e* 750,000	762,000	*e* 1,125,000	1·48	*e* 800,000	812,800	*e* 1,178,560	1·45
46	Pumice	Sh. T.	1,700	1,542	8,500	*n*5·51	144	131	720	*n* 5·51
47	Grindstones	„	36,502	33,114	342,186	10·33	38,859	35,253	438,675	12·44
48	Whetstones	..	..	..	97,229	..	..	..	107,990	..
49	Tripoli	Sh. T.	1,631	1,480	5,475	3·70	1,865	1,692	3,367	1·99
50	Slate, roofing	Squares	932,124	281,872	2,829,526	*j* 3·04	1,136,632	343,715	2,958,446	*j* 2·60
51	Manufactures	..	..	..	595,105	..	..	..	528,856	..
52	Pigment	Sh. T.	6,857	6,221	57,863	9·30	7,886	7,154	70,671	9·88
53	Soapstone	„	16,904	15,335	169,040	*n*11·02	18,862	17,111	158,635	9·27
54	Soda, natural (*r*)	„	6,350	5,761	95,400	16·56	7,150	6,486	94,650	14·59
55	Stone for building	..	..	..	*e*30,000,000	..	..	..	*e*32,500,000	..
56	Stone, limestone (flux)	L.T.	4,247,688	4,315,651	1,868,983	0·43	5,275,819	5,360,232	2,304,900	0·43
57	Stone, lithographic	Sh. T.	Nil.	Nil.	Nil.	Nil.	112	102	*n* 2,240	*n*21·96
58	Strontium sulphate	„	40	36	200	*n*5·55	2	2	10	*n* 5·55
59	Sulphur	L. T.	1,690	1,717	34,814	*m*20·28	2,726	2,770	59,754	*m*21·57
60	Sulphuric acid (*f*, *l*)	Sh. T.	42,352	38,421	699,655	*m*18·21	47,558	43,144	970,183	*m*22·49
61	Talc, common	„	10,164	9,221	90,908	9·86	9,112	8,266	78,645	9·51
62	Talc, fibrous	„	52,836	47,933	283,685	5·92	54,807	49,721	285,759	5·75
63	Tungsten ore	L. T.	(*b*)	(*b*)	*i* (*b*)	(*b*)	79	80·13	17,398	217·12
64	Uranium ore	Sh. T.	17	15	9,010	600·67	33	30	16,500	550·00
65	Wulfenite	„	Nil.	Nil.	Nil.	Nil.	12	11	144	13·09
66	Zinc sulphate	„	Nil.	Nil.	Nil.	Nil.	145	132	4,640	35·15
67	Zinc ore, exported	„	9,251	8,393	211,350	25·18	11,782	10,688	299,870	28·06
68	Zinc-white (*s*)	„	26,262	23,825	1,686,020	70·77	32,747	29,708	2,226,796	74·96
69	Est. prod. unspecified	..	..	..	5,000,000	..	..	..	5,000,000	..
	Totals	..	..	..	407,913,912	..	..	..	433,659,141	..

NOTE.—For references, see next page.

PRODUCTION OF METALS IN THE UNITED STATES.

No.	Products.	Customary Measures.	1897. Quantity. Customary Measures.	1897. Quantity. Metric Tons.	1897. Value at Place of Production. Totals.	1897. Value at Place of Production. Per M. Ton.	1898. Quantity. Customary Measures.	1898. Quantity. Metric Tons.	1898. Value at Place of Production. Totals.	1898. Value at Place of Production. Per M. Tons.
					Dols.	Dols.			Dols.	Dols
70	Aluminium	Lbs.	4,000,000	*k* 1,814,388	*m* 1,400,000	*k* 0·77	5,200,000	*k* 2,358,705	*m* 1,690,000	*k* 0·72
71	Antimony	,,	1,500,000	680	107,250	157·72	2,000,000	907	165,000	181·92
72	Copper	,,	501,370,295	227,420	*t* 55,351,281	243·40	535,900,232	243,083	*t* 63,129,047	259·70
73	Ferromanganese (*u*)	L. T.	173,695	176,474	*v* 7,989,970	45·28	213,769	217,189	*v* 10,474,681	48·23
74	Ferromolybdenum	Lbs.	Nil.	Nil.	Nil.	..	2,100	..	1,050	102·30
75	Gold	Ozs. *w*	2,864,576	*k* 89,092·4	59,210,786	*k* 664·60	3,148,642	*k* 97,933	65,082,430	*k* 664·60
76	Iron, pig	L. T.	9,478,985	9,630,649	*v* 91,009,633	9·45	11,560,165	11,745,128	*v* 110,168,372	9·38
77	Iridium	Ozs. *w*	20·25	..	606	..	8·5	..	255	..
78	Lead	Sh. T.	197,718	179,369	*m* 14,156,609	78·93	228,475	207,271	*m* 17,272,710	83·33
79	Molybdenum	Lbs.	Nil.	Nil.	Nil.	..	9,550	*k* 4,332	11,937	*k* 2·76
80	Nickel	,,	33,700	*k* 15,286·2	*m* 11,667	*k* 0·76	11,145	*k* 5,055·3	*m* 3,845	*k* 0·76
81	Platinum	Ozs. *w*	200	*k* 6·2	2,468	396·78	300	*k* 9·3	3,837	*k* 411·25
82	Quicksilver (*x*)	Flasks	26,079	905	910,418	1005·98	30,493	1,058	1,109,945	1049·09
83	Silver	Ozs.	56,457,292	*k* 1,756,004·0	33,755,815	*mk* 19·22	58,763,127	*k* 1,827,723	34,670,245	*mk* 18·97
84	Tungsten	Lbs.	Nil.	Nil.	Nil.	..	33,200	*k* 15,059	43,160	*k* 2·87
85	Zinc	Sh. T.	100,387	91,070	8,271,889	*m* 90·83	114,104	103,514	10,429,106	*m* 100·75
	Totals	..	..	..	272,178,392	..	..	..	314,255,620	..

SECONDARY MINERAL AND CHEMICAL PRODUCTS OF THE UNITED STATES.

86	Alum	Sh. T.	15,456	14,022	463,680	*m* 33·06	18,791	17,047	563,730	*m* 33·07
87	Aluminum sulphate	,,	46,355	42,053	1,158,875	*m* 27·56	56,663	51,404	1,416,675	*m* 27·56
88	Ammonium sulphate	,,	3,111	2,822	136,884	*m* 48·51	3,589	3,256	179,450	*m* 55·11
89	Calcium carbide	,,	1,925	1,746	134,750	77·18	(*b*)	(*b*)	(*b*)	(*b*)
90	Caborundum	Lbs.	1,242,929	564	153,812	272·72	1,594,152	723	151,444	209·47
91	Cement, slag	Bbls. *h*	40,000	7,258	60,000	8·27	157,662	28,606	235,721	8·24
92	Coke	Sh. T.	12,768,891	11,583,862	23,203,920	2·00	15,897,797	14,422,387	30,505,563	2·12
93	Copperas	,,	15,702	14,245	78,660	5·52	11,285	10,238	58,105	5·68
94	Copper sulphate	Lbs.	29,397,575	13,335	1,134,746	*m* 85·10	27,057,860	12,273	922,673	*m* 75·18
95	Crushed steel	Sh. T.	324	294	51,824	176·27	330	299	46,200	154·52
96	Graphite, artificial	Lbs.	162,382	*k* 73,655	10,149	*k* 0·14	185,647	*k* 84,209	11,603	*k* 0·14
97	Lead, white (*z*)	Sh. T.	105,804	95,988	9,522,360	99·20	93,172	84,525	9,391,738	111·11
98	Lead, red	,,	7,798	7,074	744,709	105·27	9,160	8,310	916,000	139·59
99	Lead, orange mineral	,,	477	433	76,320	176·26	541	491	108,200	220·37
100	Litharge	,,	8,591	7,794	773,190	99·20	7,460	6,768	710,192	104·93
101	Mineral wool	,,	5,617	5,096	61,494	12·07	6,560	5,951	70,314	11·82
102	Soda, manufactured (*r*)	M. T.	..	277,072	3,912,257	14·12	..	340,622	4,080,651	11·98
103	Venetian red	Sh. T.	2,196	1,996	40,790	20·48	3,270	2,967	64,570	21·76
	Totals	..	..	..	41,718,420	..	..	..	49,432,829	..

METALS PRODUCED FROM FOREIGN ORES AND BULLION. (*aa*)

Metals.	Customary Measure.	1897. Quantities. Customary Measure.	1897. Quantities. Kgm.	1897. Values.	1898. Quantities. Customary Measure.	1898. Quantities. Kgm.	1898. Values.
				Dols.			Dols.
Copper	Pounds	26,938,254	12,219,112	2,973,983	36,055,352	16,354,600	4,247,320
Gold	Troy ozs.	584,983	18,195	12,091,599	1,065,552	33,142	22,024,960
Lead	Short tons	92,117	83,568,000	6,595,577	89,209	80,929,874	6,744,200
Nickel	Pounds	4,099,390	1,859,000	1,419,209	7,127,784	3,233,142	2,459,085
Silver	Troy ozs.	40,218,776	1,250,934	24,046,806	39,784,090	1,237,560	23,472,560
Total values	..	..	..	47,127,174	..	..	58,948,125

The following notes refer to the four preceding tables:—(*a*) Except where otherwise specified. (*b*) Not enumerated. (*c*) Amount or value of crude mineral. (*d*) Partly estimated. (*e*) Estimated. (*f*) Amount recovered as a by-product. (*g*) Barrels of 300 lbs. (*h*) Barrels of 400 lbs. (*i*) Includes manganiferous iron ore; this is not duplicated in the report of iron ore. (*j*) Value per square, *i.e.*, 100 sq. ft. lapped and laid: the weights are calculated on the basis 3 squares = 2,000 lb., but these figures are only approximately correct. (*k*) Kilograms or per kilogram. (*l*) Reduced to a basis of 66° B. (*m*) Average market price at New York. (*n*) Nominal. (*o*) Value before grinding. (*p*) Includes ochre, umber, sienna, and oxide of iron. (*q*) Includes salt used for the manufacture of alkali; the barrel of salt weighs 280 lb. (*r*) Reduced to a basis of 58 per cent. ash. (*s*) Includes a small amount made from spelter. (*t*) Average value of Lake copper at New York, less 0·25 cent per lb. (*u*) Includes spiegeleisen, though the total value is reckoned as if the whole product were ferromanganese. (*v*) Average market price at Pittsburg. (*w*) Troy ozs. (*x*) Flasks of 76·5 lbs. (*y*) Barrels of 42 galls. (*z*) Includes a comparatively small amount made directly from ores. (*aa*) Not included in the preceding tables.

Abbreviations: Sh. T., short tons (2,000 lbs.); L. T., long tons (2,240 lbs.); M. T., metric tons (2204·6 lbs.).

PETROLEUM ON RUSSIAN RAILROADS.

Eng. and Mining J., April 8, 1899, 160.

The use of petroleum as fuel for locomotive purposes on the Trans-Caucasian Railroad was first introduced on the local line between Baku and Balachany in 1880. The consumption amounted to 110,000 poods (1,800 tons), and the price paid was 4·2 kopeks per pood. In 1883, when the Baku-Tiflis line was opened, the quantity of fuel used increased very rapidly; in that year no less than 890,000 poods (14,800 tons), were consumed, and in 1889, 4,819,000 poods (80,000 tons). Since 1889, at the time when the railway was taken over by the Government, the quantity of fuel used considerably increased, and wood and coal previously consumed were displaced by petroleum. In 1889 the wood used for locomotives amounted to some 5,762 cubic sajean; in 1890 this had fallen to 288 cubic sajean; in 1895 to 585; in 1896 the quantity was only 5·27, and in 1897, 6·20 cubic sajean.

During the last five years residuals ("astatki') for locomotives have been used to the following extent. In 1894 the quantity was 6,160,000 poods (100,000 tons), the price being 13·30 kopeks per pood; 1895, 6,200,000 poods (103,000 tons), at a price of 5 kopeks; 1896, 6,400,000 poods (106,000 tons), at 7·25 kopeks; 1897, 8,000,000 poods (130,000 tons), at 8·10 kopeks; 1898, 8,705,000 poods (145,000 tons), at 9·2 kopeks per pood (2·75 dols. a ton).

The introduction of residuals as fuel has considerably reduced the expenditure of the line. At the present time the road uses the liquid fuel not only in locomotives, but also in all the workshops and at all their pumping stations. In 1896 on the whole of the railroad lines of Russia, 62,600,020 poods of liquid fuel was used, and of this quantity the Trans-Caucasian consumed 12 per cent. The line represents between 2 to 2½ per cent. of the total railroad mileage of Russia. The Trans-Caucasian Railroad has now 61 tank storage places, with a total capacity of 2,154,350 poods. These vary in size from tanks holding 60,000 poods, at Baku, down to tanks of 1,000 poods at stations where there are pumping engines.

Mineral Production of Ontario, 1898.

Eng. and Mining J., Aug. 5, 1899, 160.

Product.	Quantity.	Value.	Employees.	Total Wages paid.
		Dols.		Dols.
Building stone, rubble, &c.	..	750,000	1,250	520,000
Cement, natural rock, barrels.	91,528	74,222	85	23,784
Cement, Portland, barrels.	153,348	302,095	220	104,350
Lime, bushels.........	2,620,000	308,000	548	127,000
Drain tile, number....	22,668,000	225,000	2,622	456,000
Common brick, number	170,000,000	914,000		
Pressed brick and terra cotta, number.	7,754,868	87,894	114	38,980
Sewer pipe	..	93,717	77	26,260
Pottery...............	..	155,000	164	61,000
Petroleum (imperial gallons).	26,978,977	..	..	..
Illuminating oil (imperial gallons).	12,281,622	1,243,490	546	263,455
Lubricating oil (imperial gallons).	2,043,226	202,150		
Benzine and naphtha (imperial gallons).	1,240,967	121,840		
Gas and fuel oils and tar (imperial gallons).	8,047,441	286,705		
Paraffin wax and candles (lbs.)	2,616,086	116,349		
Natural gas...........	..	301,600	85	31,457
Carbide of calcium, (tons).	574	34,440	30	12,544
Salt (tons)	59,385	278,886	191	60,629
Gypsum (tons)	3,000	4,000	15	2,000
Graphite (tons).......	300	6,000	10	1,800
Mica (tons)...........	34	7,500	15	4,500
Metallic:				
Iron ore (tons)	27,409	48,875	100	26,700
Pig iron (tons)	48,253	530 7-9	130	61,476
Nickel (tons).........	2,283¾	314,220	637	315,501
Copper (tons).........	4,186¼	268,080		
Gold (oz.)	16,261	275,078	580	290,919
Silver (oz.)	86,600	51,960	59	28,430
Totals	..	7,201,891	7,478	2,456,785

Net tons of 2,000 lbs. are used.

Manufacture of Caffeine.

Chem. and Druggist, Aug. 19, 1899, 340.

The export of denatured tea to Germany is now very rge, and the Germans send back to this country the pre- red drug as citrate of caffeine, or in other forms. Of 177,206 lb. of denatured tea, 143,167 lb. was exported, and only 34,039 lb. retained by British caffeine-makers. This covers a period of three months, says *Commercial Intelligence*, but our contemporary does not say when. We presume this year.

Export of Tinctures and Medicinal Spirits.

Chem. and Druggist, Aug. 19, 1899, 340.

For the quarter which ended on June 30, the Excise have paid drawback on 19,431 galls. of proof spirit contained in the various medicinal tinctures exported during that period. This is a substantial increase over the same quarter of last year, during which drawback on 16,285 galls. of proof spirit was repaid, and is evidence of the growing nature of the trade which has resulted from the concessions obtained from the Excise.

Exportation of Coca-Leaves and Cocaine from Peru.

Chem. and Druggist, August 19, 1899, 314.

A French consular report states that the business in cocaine and coca-leaves in Peru has greatly developed of late years, as the following export figures, representing kilos., show:—

—	1891.	1892.	1893.	1894.	1895-6.	1897.
Coca leaves ...	128,543	388,465	390,955	372,360	..	495,677
Crude cocaine.	3,216	4,550	2,357	4,716	..	5,207

The bulk of the above went to Hamburg. An endeavour has been made to export the drug direct from Lima to Havre, but up to the present it has not succeeded, so that French manufacturers have still to go to Hamburg for their supplies. A movement is on foot to establish a line of steamers to ply between Peru and Havre.

The World's Copper Production, 1897-98. (*a*)

Eng. and Mining J., Aug. 12, 1899, 182.

Countries.	1897.		1898.	
	Tons of 2,240 Lb.	Metric Tons.	Tons of 2,240 Lb.	Metric Tons.
Algeria	Nil.	Nil.	50	51
Argentina	200	203	125	127
Australasia	17,000	17,272	18,000	18,288
Austria-Hungary	1,655	1,681	1,540	1,565
Bolivia	2,200	2,235	2,050	2,083
Canada	5,905	5,999	8,040	8,169
Cape of Good Hope:				
Cape Company........	5,290	5,375	4,660	4,735
Namaqua..............	2,150	2, 15	2,400	2,438
Chile	21,900	22,250	24,850	25,248
Germany:				
Mansfeld	17,960	18,247	18,045	18,334
Other mines	2,185	2,220	2,040	2,073
Italy	3,480	3,536	3,435	3,490
Japan.....................	23,000	23,368	25,175	25,578
Mexico:				
Boleo.................	10,170	10,334	9,436	9,587
Other.................	1,200	1,219	6,232	6,332
Newfoundland..........	1,800	1,829	2,100	2,134
Norway..................	3,450	9,505	3,615	3,673
Russia....................	6,025	6,121	6,000	6,096
Peru......................	1,000	1,016	3,040	3,089
Spain-Portugal:				
Rio Tinto.............	33,900	34,442	33,705	34,244
Tharsis	12,000	12,192	12,000	12,192
Mason and Barry	4,300	4,369	3,600	3,658
Sevilla..................	810	823	800	813
Other mines	3,050	3,099	3,120	3,170
Sweden..................	545	554	480	488
United Kingdom........	555	564	550	559
United States...........	223,825	227,420	239,241	243,069
Venezuela	Nil.	Nil.	Nil.	Nil.
Totals	405,350	412,088	434,329	441,283

(*a*) The figures in this table are taken from the annual metal circular of Henry R. Merton and Co., except where returns have been received by the Mineral Industry direct from producers.

CONNELLSVILLE COKE PRODUCTION IN 1899.

Eng. and Mining J., August 12, 1899, 184.

According to the figures collected by the Connellsville *Courier*, the output of coke from the Connellsville region in Pennsylvania was greater for the first six months in 1889 than for any other half year in the history of the region by 640,000 tons. The shipments from January 1 to July 1 aggregated 248,619 cars, containing 4,792,139 tons, which indicates that the production of the region for the year will be nearly 10,000,000 tons. This will be close to 2,000,000 tons more than in 1898, when the shipments amounted to 8,460,113 tons.

The new ovens in course of erection in the region show that it is not ready for the additional investment of money in the construction of by-product ovens. The bee-hive oven is still in universal use in the district, the only exception being the Semet-Solvay plant of 50 ovens at Dunbar.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st July.	
	1898.	1899.
	£	£
Metals	1,847,311	2,470,926
Chemicals and dyestuffs	418,269	438,029
Oils	657,845	852,169
Raw materials for non-textile industries.	5,323,559	5,852,130
Total value of all imports	35,903,039	39,935,372

SUMMARY OF EXPORTS.

Articles.	Month ending 31st July.	
	1898.	1899.
	£	£
Metals (other than machinery)	2,749,593	3,583,948
Chemicals and medicines	637,031	635,987
Miscellaneous articles	2,756,039	2,900,622
Total value of all exports	20,089,878	23,195,958

IMPORTS OF METALS FOR MONTH ENDING 31ST JULY.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Copper :—					
Ore	Tons	13,232	14,700	39,812	94,520
Regulus	,,	4,897	6,211	123,480	194,518
Unwrought	,,	6,311	4,990	320,003	377,105
Iron :—					
Pig and puddled	,,	16,460	12,315	56,495	47,712
Ore	,,	522,416	631,417	391,088	482,212
Bolt, bar, &c.	,,	5,315	7,334	42,649	59,098
Steel, unwrought	,,	3,433	6,417	19,344	33,979
Lead, pig and sheet	,,	18,544	19,256	244,194	269,762
Pyrites	,,	64,677	67,504	111,186	113,845
Quicksilver	Lb.	17,700	438,075	1,769	48,863
Silver ore	Value £	..	..	96,170	129,398
Tin	Cwt.	28,829	43,373	96,431	262,598
Zinc	Tons	6,497	4,406	113,923	111,691
Other articles	Value £	..	..	190,767	245,625
Total value		..	..	1,847,311	2,470,926

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH ENDING 31ST JULY.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Alkali	Cwt.	23,268	27,496	12,298	14,448
Bark (Tanners', &c.)	,,	38,499	33,156	20,702	14,536
Borax	,,	4,645	6,059	2,126	2,957
Brimstone	,,	24,340	35,786	6,158	8,546
Chemicals	Value £	..	..	124,912	111,712
Cochineal	Cwt.	433	262	2,599	1,528
Cutch and gambier	Tons	1,771	3,013	31,375	48,189
Dyes :—					
Alizarin	Value £	..	..	15,671	21,656
Anilin and other	..	..	..	49,550	39,865
Indigo	Cwt.	1,081	1,073	18,833	14,969
Nitrate of potash	,,	19,755	14,032	14,123	11,705
Valonia	Tons	3,088	2,982	32,555	35,602
Other articles	Value £	..	..	87,337	112,316
Total value		..	..	418,269	438,029

IMPORTS OF OILS FOR MONTH ENDING 31ST JULY.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Cocoa-nut	Cwt.	9,217	13,721	10,505	15,756
Olive	Tuns	2,556	1,392	81,749	45,863
Palm	Cwt.	105,357	76,731	110,098	83,293
Petroleum	Gall.	12,538,203	23,334,592	242,923	427,087
Seed	Tons	1,813	2,955	35,366	56,897
Train, &c.	Tuns	2,271	2,901	38,377	49,248
Turpentine	Cwt.	42,463	63,099	43,930	92,642
Other articles	Value £	..	..	94,897	81,383
Total value		..	..	657,845	852,169

IMPORTS OF RAW MATERIAL FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 31ST JULY.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Bark, Peruvian	Cwt.	1,429	7,262	3,079	15,922
Bristles	Lb.	368,571	545,724	46,722	80,567
Caoutchouc	Cwt.	35,515	28,743	421,521	348,476
Gum :—					
Arabic	,,	2,648	5,121	6,705	11,325
Lac, &c.	,,	7,357	9,433	28,819	32,308
Gutta-percha	,,	5,844	6,874	57,736	82,760
Hides, raw :—					
Dry	,,	35,383	47,386	100,615	125,676
Wet	,,	50,341	48,461	107,313	100,936
Ivory	,,	1,059	1,597	46,312	59,052
Manure :—					
Guano	Tons	1,295	1,367	5,194	10,575
Bones	,,	1,760	3,303	7,421	16,453
Nitrate of soda	,,	8,842	7,994	68,585	59,388
Phosphate of lime	,,	21,263	33,841	275,835	397,122
Paraffin	Cwt.	58,803	61,070	47,145	56,449
Linen rags	Tons	1,933	1,845	16,958	15,240
Esparto	,,	7,693	11,406	29,593	45,857
Pulp of wood :—					
Chemical	,,	13,025	17,242	89,684	131,225
Mechanical	,,	23,405	30,162	60,588	71,936
Resin	Cwt.	194,623	131,804	43,289	31,885
Tallow and stearin	,,	220,524	184,836	228,447	210,969
Tar	Barrels	12,514	14,924	8,050	11,476
Wood :—					
Hewn	Loads	242,634	285,612	584,304	591,707
Sawn	,,	906,183	1,032,559	2,144,094	2,531,807
Staves	,,	20,909	12,599	67,148	51,845
Mahogany	Tons	2,862	2,273	26,036	21,851
Other articles	Value £	..	..	1,047,289	1,079,724
Total value		..	..	5,323,559	5,852,130

Besides the above, drugs to the value of 82,118*l*. were imported, as against 67,221*l*. in July 1898.

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 31ST JULY.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Brass............ Cwt.	7,213	11,791	34,018	55,115
Copper:—				
Unwrought.... „	52,640	38,889	139,121	154,253
Wrought...... „	19,133	15,403	60,312	67,527
Mixed metal... „	13,552	7,345	33,843	25,178
Cutlery.........Value £ Hardwares....... „	..	..	160,892	172,370
Implements...... „	..	..	111,485	123,552
Iron and Steel ... Tons	281,194	370,014	1,955,027	2,631,313
Lead............. „	2,732	3,553	40,608	54,820
Plated wares... Value £	..	..	33,853	32,545
Telegraph wires.. „	..	..	45,600	97,635
Tin.............. Cwt.	7,447	9,840	26,679	60,625
Zinc............. „	21,674	7,211	19,720	9,874
Other articles...Value £	..	..	88,435	99,142
Total value.......	..	..	2,749,593	3,583,948

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 31ST JULY.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali........... Cwt.	282,400	269,989	75,109	75,293
Bleaching materials „	91,246	81,380	25,335	19,968
Chemical manures Tons	48,758	35,939	195,396	174,991
Copper sulphate .. „	1,745	486	27,677	11,660
Medicines....... Value £	..	..	84,886	89,705
Other articles... „	..	..	228,628	264,370
Total value..........	..	..	637,031	635,987

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH ENDING 31ST JULY.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Gunpowder. ... Lb.	1,082,200	527,300	23,668	12,268
Military stores.. Value £	..	..	179,140	155,169
Candles......... Lb.	2,204,100	2,201,000	29,218	32,546
Caoutchouc..... Value £	..	..	106,574	113,133
Cement......... Tons	80,053	37 074	56,270	70,993
Products of coal. Value £	..	..	111,927	108,344
Earthenware ... „	..	..	144,459	164,134
Stoneware...... „	..	..	14,749	13,318
Glass:—				
Plate.......... Sq. Ft.	124,903	123,563	7,830	7,458
Flint.......... Cwt.	7,287	7,272	16,625	16,646
Bottles........ „	58,587	56,201	27,836	26,105
Other kinds ... „	18,363	16 090	16,586	15,208
Leather:—				
Unwrought.... „	11.671	12,428	107,720	110,116
Wrought......Value £	..	..	27,444	33,692
Seed oil......... Tons	3,064	2,614	58,762	54,430
Floorcloth.......Sq. Yds.	1,699,900	2,169,500	75,490	96,707
Painters' materials Val. £	..	..	132,953	154,348
Paper............. Cwt.	76,885	74,270	119,252	114,074
Rags.............. Tons	5,224	5,575	26,197	27,713
Soap.............. Cwt.	71 116	85,987	75,988	83,374
Total value.........	..	..	2.756,039	2,900,622

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

14,694. L. Boudart. Improvements in carburetters. July 17.

14,862. W. Jackson. Improvements in the method of and means for cleansing or removing incrustation from the interior of steam generators. July 19.

14,890. M. Guttner. Centrifugal apparatus with continuous action. Complete Specification. July 19.

14,919. E. Borsari. Improvements in the manufacture of articles adapted to resist the action of acids or other chemicals. July 19.

15,235. C. E. Tripler. Apparatus for liquefying atmospheric air and utilising the same. Complete Specification. July 25.

15,286. L. Lederer and J. Gottlieb. Improvements in automatic carburettors. July 25.

15,292. M. de Marchéville. Improvements in centrifugal machines. July 25.

15,296. A. A. Humphrey. Improvements in compressing air. July 25.

15,387. J. McLay. Improvements in heat non-conducting coverings and mode of manufacture. July 27.

15,608. B. Kilner and S. Laycock. Improvements in charging apparatus for feeding fuel or smelting charges to gas producers, blast furnaces, coke ovens, and the like. July 31.

15,718. C. Joly. Improved system for the safe storage, transport, and use of volatile liquids. Aug. 1.

15,738. P. Greyson de Schodt. Improvement in hydraulic compressors. Aug. 1.

15,739. P. Greyson de Schodt. Improvements in steam compressors. Aug. 1.

15,754. A. J. Boult.—From C. Krausse, Germany. Improved refrigerating process and apparatus therefor. Complete Specification. Aug. 1.

16,065. Siemens, Bros. & Co., Ltd.—From Siemens and Halske, Aktien Gesellschaft, Germany. Improvements in apparatus for compressing granular and pulverulent substances. Aug. 5.

16,080. A. J. Boult.—From Mrs. L. Longuemare, France. Improvements in or relating to carburettors. Complete Specification. Aug. 5.

16,161. J. Armstrong. Improved reverberatory furnace. Complete Specification. Aug. 8.

16,304. R. Landmann and N. Reif. Improved process and apparatus for centrifuging, drying, impregnating and moulding plastic materials. Complete Specification. Aug. 10.

16,381. W. Witkowitch. Improvements in apparatus for heating or cooling liquids, air, or gases. Complete Specification. Aug. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1898.

16,808. J. Weck. Air-tight provision receptacles suitable for use with sterilising apparatus. Aug. 2.

18,234. C. Huber. Construction of chambers or receptacles for drying, evaporating, heating, or cooling substances. July 26.

18,770. W. Riley and A. Kershaw. Gas holder. Aug. 10.

19,461. J. B. Spurge. Valves for regulating the flow of gases and liquids under pressure. Aug. 2.

20,232. J. S. Lethem. Furnaces. Aug. 2.

20,509. E. W. Lucas. Condensing apparatus.

21,499. H. Winckler. Machines for drying fish, offal, stable, town, and slaughter-house refuse, and other material requiring similar treatment. Aug. 16.

21,797. M. Arndt. Apparatus for measuring and indicating the pressure of gas. Aug. 10.

22,437. J. S V. Bickford. Apparatus for effecting combustion of liquid fuel for furnaces and the like. Aug. 16.

1899.

7612. J. R. Whiting and W. A. Lawrence. Apparatus for the separation and recovery of valuable vapours. Aug. 16.

8779. J. West. Regenerators for gas-retorts, smelting furnaces, coke-ovens, and kilns. Aug. 2.

10,072. W. H. Jones. Stills. Aug. 2.

10,324. C. V. F. Ludwig and G. Cramer. Filtering apparatus. July 26.

11,649. A. J. Boult.—From F. Correll, Germany. Drying, heating, cooling, or impregnating of granular and other material, and apparatus therefor. Aug. 16.

12,361. D. Boyle. Carbonating apparatus. Aug. 2.

12,841. L. O. Boeing. Filling for evaporating, concentrating, and condensing towers, and similar apparatus. Aug. 2.

II.—FUEL, GAS, AND LIGHT.

Applications.

14,714. J. S. Smith. Improvements in the generation of acetylene gas. July 17.

14,984. C. M. Bridges. Acetylene gas generator. Complete Specification. July 20.

15,020. J. Aykroyd and B. Aykroyd. Improvements in acetylene generators and holders. July 21.

15,044. The Patent Aggloment Fuel Syndicate, Ltd., H. C. B. Forester, and J. A. A. Yeo. Improvements in or relating to the manufacture of artificial fuel, and apparatus therefor. July 21.

15,119. A. H. Grautoff and F. Fritz. Improvements in burners for gas-lighting by incandescence. July 22.

15,239. J. H. Exley. Improvements in filtering and purifying hydrocarbon gases and filtering bodies therefor. July 25.

15,344. D. M. Steward. Improvements in gas burners specially adapted for acetylene gas. Complete Specification. July 26.

15,403. H. Schild. Process for coking mineral coal and lignite. July 27.

15,406. L. Bartmann. Improved acetylene gas generators. Complete Specification. July 27.

15,506. E. J. Dolan. An improved method of packing calcium carbide, and generating acetylene gas therefrom. Complete Specification. July 28.

15,511. W. H. Laird. An improved process of and apparatus for manufacturing gas. July 28.

15,521. W. T. Sugg. Improvements relating to incandescent gas lighting. July 28.

15,545. J. Snodgrass. *See* Class VII.

15,598. G. Bamberg. Improvements in or relating to incandescent gas burners. July 29.

15,608. B. Kilner and S. Laycock. *See* Class I.

15,662. F. Radcliffe. Improvements in gas producers. July 31.

15,826. E. Riotte. Improvements in apparatus for generating acetylene gas. Aug. 2.

15,977. W. Higgins and H. Sandilands. Improvements in apparatus for the production of acetylene gas. Aug. 4.

16,002. G. Seagrave. Improvements connected with acetylene gas producing apparatus. Aug. 4.

16,020. T. H. Gittings. An improved artificial fuel. Aug. 5.

16,036. W. B. Johnson.—From J. A. Faux, United States. Improvements in the manufacture of gas. Complete Specification. Aug. 5.

16,053. J. Apt. Improvements in the manufacture of illuminating media for use in incandescent gas lighting. Aug. 5.

16,056. L. Friedeberger and The Vulcan Gesellschaft für Selbstzündende Gluhkorper mit Beschränkter Haftung. Improved process of manufacturing igniters for gas. Aug. 5.

16,079. C. S. Cochrane. An improved fuel. Aug. 5.

16,147. F. Schwander, junior. Process of and apparatus for the production of gas for illuminating and other purposes. Aug. 8.

16,154. E. N. Coppée. Improvements in coke ovens. Aug. 8.

16,166. A. J. Boult.—From F. Isitt, New South Wales. An improved manufacture of mantles to be used in incandescent gas lighting. Complete Specification. Aug. 8.

16,194. M. Moses. Acetylene gas generator. Aug. 9.

16,235. L. Partl. Improved acetylene gas generator and apparatus. Aug. 9.

16,265. W. H. Dargue. Improvements in the generation of acetylene gas. Aug. 10.

16,287. D. J. van Praag and F. W. Harker. Improvements in acetylene generators. Aug. 10.

16,409. T. Thorp. A new and improved prismatic combination for daylight illumination. Aug. 12.

12,426. E. Hilberg. Improvements in acetylene generators. Complete Specification. Aug. 12.

12,446. J. Nielsen. New or improved acetylene gas apparatus. Aug. 12.

16,456. E. L. H. Chauvin. Improvements in automatic generators for acetylene gas. Filed Aug. 12. Date applied for Feb. 3, 1899, being date of application in France.

16,459. J. Ponces. Improvements in acetylene gas generators. Aug. 12.

Complete Specifications Accepted.

1898.

11,676. E. Evans. Apparatus for washing and purifying gas. Aug. 2.

13,164. P. Naef and R. S. Garton. Process and apparatus for producing coke-gas and by-products. July 26.

13,165. P. Naef and R. S. Garton. Process and apparatus for producing coke-gas and by-products. July 26.

16,670. H. H. Böhndel and C. C. Yeaton. Process for the production of gas for illuminating and other purposes. Aug. 2.

17,230. W. Smith. Water jacket for acetylene gas generators. Aug. 2.

17,414. I. Priestley. Apparatus applicable to steam boiler and other furnaces for consuming smoke and economising fuel. July 26.

17,751. P. M. A. Drouot. Means for atomising and diffusing combustible liquids. July 26.

18,436. G. Matthyssens. Acetylene producers. July 26.

18,741. W. L. Wise. From F. C. Wilson, United States. Apparatus suitable for generating and supplying acetylene gas and the like. July 26.

19,149. J. S. Goodwin. Acetylene generators. Aug. 16.

19,439. J. Wishart. Method and means for congealing and separating solid paraffin from liquid hydrocarbons. Aug. 10.

20,122. B. H. Wallin and Baron R. de Wendel. Apparatus for generating acetylene gas. Aug. 16.

20,206. E. Andreoli. Ozonisers. Aug. 2.

20,839. T. Rosethorn. Heating liquids. Aug. 16.

20,996. H. H. Lake.—From R. Türr, France. Apparatus for the production of acetylene gas. Aug. 2.

21,038. J. McConechy. Apparatus for the production of acetylene gas. Aug. 10.

21,462. W. Foster. Stoppers used in gas retorts. Aug. 2.

22,437. J. S. V. Bickford. *See* Class I.

24,002. L. Troubetzkoy. Acetylene gas apparatus. Aug. 10.

1899.

394. J. S. Goodwin. Apparatus for burning inflammable liquids. Aug. 10.

2443. S. P. Bowen. Gas valve for coke ovens. Aug. 16.

3290. H. H. Böhndel and C. C. Yeaton. Apparatus for the manufacture of combustible gas. Aug. 16.

6274. R. H. Sunderland, F. Sunderland, and G. Marshall. Acetylene gas generators. Aug. 10.

8765. O. Boettcher. Acetylene gas generator. July 26.

10,685. L. Galicki, J. Lopatin and P. Lopatin. Process for working peat, and manufacturing the same into briquettes. Aug. 16.

11,116. E. Fenderl. Generation of acetylene gas. Aug. 10.

11,169. Count A. Dillon de Micheroux. Manufacturing agglomerated fuel blocks. Aug. 10.

11,494. E. Hilberg. Acetylene generators. Aug. 2.

12,429. A. J. Boult.—From E. Salzenberg, Germany. Process for the production of incandescent gas light. Aug. 10.

12,659. G. Nowak and P. Klemm. Acetylene generator. July 26.

12,885. Count G. de Roussy de Sales and L. Braly. Carburetters. July 26.

13,301. J. N. Goldbacher and E. Bournonville. Acetylene gas apparatus. Aug. 2.

13,325. F. W. C. Schniewind. Coke ovens and method of operating the same. Aug. 10.

13,339. G. C. Marks.—From The Pauli Lamp Company, United States. Self-generating and self-regulating acetylene gas-producing apparatus. Aug. 16.

13,723. L. J. F. Nicolai and A. McNab. Means and apparatus for the production of gas specially intended for incandescent lighting and for heating purposes. Aug. 10.

13,888. J. M. Hadden. Illuminating gas apparatus. Aug. 10.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Applications.

14,760. P. Schneider. An improved apparatus for extracting pyroligneous spirit from saw-dust. Complete Specification. July 18.

15,238. W. Young and J. Fyfe. Improvements in and relating to retorts for the destructive distillation of shale. Complete Specification. July 25.

IV.—COLOURING MATTERS and DYES.

Applications.

14,695. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. A new process for the production of nucleinic acids. July 17.

14,834. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering, Germany. The production of therapeutic substances from quinic acid and hexamethylene tetramine. July 18.

14,957. C. F. Power. An absorbent writing ink which can be made of many different colours, either from the vegetables or minerals. July 20.

14,964. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new dyestuffs of the diphenylnaphtylmethane series. July 20.

14,980. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. The manufacture and production of aromatic amido-aldehydes. July 20.

15,074. G. W. Johnson.—From Kalle and Co., Germany. Improvements in the manufacture and production of dyestuffs. July 21.

15,416. T. R. Shillito.—From J. R. Geigy and Co., Switzerland. Production of isatine anilide and of isatine. July 27.

15,433. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of new leuco-bases of the triphenylmethane derivatives and of colouring matters therefrom. July 27.

15,497. T. R. Shillito.—From J. R. Geigy and Co., Switzerland. Manufacture and production of α-isatine anilide and of indigo, and indigo red therefrom. July 28.

15,983. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Process for transforming rhodols and rhodol esters into dyestuffs fast to soap. Aug. 4.

16,067. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Process for alkylating dialkyl-rhodamines. Aug. 5.

16,068. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Process for alkylating dialkyl-rhodamines. Aug. 5.

16,135. R. Holliday and Sons, Ltd., J. Turner, H. Dean, and J. Turner. Improvements in the manufacture of colouring matters. Aug. 8.

16,149. R. B. Ransford.—From L. Casella and Co., Germany. Manufacture of a new diamidonaphtol and salts of the same. Aug. 8.

16,153. O. Imray.—From The Farbwerke vormals Meister, Lucius, und Brüning, Germany. Process for rendering nitroso-bases stable. Aug. 8.

16,250. R. M. Sallher. *See* Class XI.

16,295. O. Imray. — From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of cotton dyestuffs. Aug. 10.

Complete Specifications Accepted.

1898.

19,075. G. B. Ellis.—From La Société Chimique des Usines du Rhône anciennement G. P. Monnet et Cartier, France. Manufacture of azo dyestuffs. Aug. 16.

19,088. C. Rudolph. Chlorinated naphthalene sulphonic acids. July 26.

19,327. S. Pitt.—From L. Casella and Co., Germany. Manufacture of aromatic nitramine monohalides and colouring matters derived therefrom. July 26.

20,063. B. Willcox.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of new colouring matters, and of new intermediate products relating thereto. Aug. 2.

21,057. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of anthraquinone dyestuffs. Aug. 16.

21,157. B. Willcox.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of indigo leuco products and colouring matters, and of intermediate compounds relating thereto. Aug. 10.

21,415. J. Imray.—From La Société L. Durand Huguenin and Cie., Germany. Manufacture of leuco derivatives of gallocyanins. July 26.

21,496. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of yellow basic colouring matters. Aug. 16.

21,839. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of dyestuffs of the diphenylnaphthylmethane series. July 26.

23,435. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of basic phenol ethers. Aug. 16.

23,615. H. H. Lake. — From Farbwerke Mühlheim, formerly A. Leonhardt and Co., Germany. Manufacture of colouring matters. Aug. 16.

23,644. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of oxyanthraquinones and oxyanthraquinone sulphonic acids. Aug. 16.

23,985. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of basic safranine azo dyestuffs soluble in water. Aug. 16.

24,177. Vidal Fixed Anilin Dyes, Ltd., and L. Haas. Manufacture of colouring matters. Aug. 16.

1899.

1678. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. *See* Class XX.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

15,064. O. Imray.—From G. Roland and F. Peterhauser, Germany. A process for decoloration of rags and shoddies. July 21.

15,125. J. Erskine and T. M. Erskine. Improvements in machines or apparatus employed in the manufacture of waterproofed felt. July 22.

15,397. T. Robinson. A new or improved construction of machine for use in the mercerising of cloth. July 27.

15,729. H. Krantz. Improvements in or relating to apparatus for use in stretching, drying, and carbonising fabrics, and the like. Complete Specification. Aug. 1.

16,049. T. Burrows and J. F. Woods. Improvements in washing ramie rhea China grass or other fibre in the process of preparing same for spinning and apparatus therefor. Aug. 5.

Complete Specifications Accepted.

1898.

22,101. W. E. Aykroyd, W. H. Aykroyd, and H. E. Aykroyd. Apparatus for the mercerisation of cotton or other fibrous materials. Aug. 10.

1899.

11,772. W. Erben. Extracting grease from wool, and apparatus therefor. Aug. 2.

12,556. C. Logan.—From C. H. Hubbell, United States. Mineral wool. Aug. 10.

13,237. A. Wolstenholme. Rubbing aprons for use in the manufacture of worsted yarns. Aug. 2.

14,329. P. Jeanmaise. Mercerising apparatus. Aug. 16.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, and BLEACHING.

Applications.

14,849. W. G. Heys.—From L. Campsque, Holland. Improvements in the method of dyeing and similarly treating textile materials and fabrics in all stages of preparation and manufacture. July 19.

14,895. F. M. Spence, D. D. Spence, and A. Shearer. Improvements in the manufacture of certain products used in mordanting and for other purposes. July 19.

14,932. E. J. Brown. Improvements in machines for washing, soaping, scouring, mordanting, bleaching, dyeing, sizing, filling, mercerising, and drying spun or twisted fibres in the thread hank warp or fabric. Complete Specification. July 20.

15,866. W. Rumney and Co., Ltd., and A. S. Young. Improvements in and relating to the printing of textile fabrics. Aug. 3.

16,301. F. H. Oldroyd. Process of completely decolourising dyed fibrous material. Complete Specification. Aug. 10.

16,422. J. Major and T. J. Wood. Improvements in apparatus for dyeing, bleaching, or otherwise treating with liquids cops of yarn. Aug. 12.

Complete Specifications Accepted.

1898.

19,858. S. Khrèmikoff. Apparatus for boiling, bleaching, and dyeing cotton and the like fabrics. Aug. 10.

1899.

167. H. A. Costobadie. Printing and dyeing textile fabrics. Aug. 10.

6249. G. Tagliani. Process for the dyeing of textile fabrics. Aug. 10.

7903. B. Thies. Method of bleaching, dyeing, and washing fabrics with liquid, and apparatus therefor. Aug. 16.

11,803. H. Honegger. Process and apparatus for bleaching and dyeing. Aug. 10.

VII.—ACIDS, ALKALIS, and SALTS.

Applications.

15,151. A. Clemm. Improvements in means to be employed in the manufacture of sulphuric acid. July 22.

15,152. A. Clemm. Improvements in the manufacture of sulphates and of chlorine. July 22.

15,306. C. J. Wollaston. Improvements in and apparatus for or connected with the manufacture or production of calcium carbide or magnesium carbide. July 25.

15,545. J. Snodgrass. Improvements in the manufacture of cyanides. July 29.

15,651. L. Maissin. Improvements in or connected with the manufacture of nitric acid. July 31.

16,128. H. L. Hartenstein. Improvements in process of manufacturing metallic carbides. Complete Specification. Aug. 8.

Complete Specifications Accepted.

1898.

15,947. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik, Germany. Manufacture of sulphuric anhydride and sulphuric acid, and apparatus to be employed therein. July 26.

15,948. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik, Germany. Manufacture of sulphuric anhydride. July 26.

15,949. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik, Germany. Apparatus for the manufacture of sulphuric anhydride. July 26.

15,950. J. Y. Johnson.—From The Badische Anilin and Soda Fabrik, Germany. Manufacture of sulphuric anhydride and apparatus for use therein. July 26.

17,266. G. W. Johnson.—From The Verein Chemischer Fabriken, Germany. Manufacture of sulphurous acid, sulphuric acid, and sulphuric anhydride. Aug. 10.

20,681. R. W. E. MacIvor and T. F. Spencer. *See* Class X.

1899.

14,261. A. J. Boult.—From W. S. Horry, United States. Method of procuring carbide of calcium. Aug. 26.

VIII.—GLASS, POTTERY, and ENAMELS.

Applications.

14,725. F. Mountford. Novel or improved apparatus for use in decorating ceramic ware. July 18.

Complete Specifications Accepted.

1898.

17,941. F. Handcock. Manufacture of pottery from plaster moulds and applied mechanism. July 26.

18,729. T. Pfister. Manufacture of enamelled cloisonné. Aug. 16.

20,100. C. H. Temple. Process or method of printing designs upon tiles and other clay ware from a photographic half tone process block or plate. Aug. 2.

1899.

5012. G. C. Dymond.—From J. W. Colburn, United States. Glass working apparatus. June 28.

11,058. E. K. B. Rohardt and F. A. Teifke. A kiln furnace or oven for ceramics. Aug. 2.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

15,026. W. R. Cochrane. A new or improved cement. July 21.

15,080. A. G. Salamon. Improvements in the manufacture of refractory materials for building and other purposes. July 21.

15,132. C. J. Potter. Improvements in the manufacture of cement. July 22.

15,640. F. Gernaert and C. Libert. An improved process for the manufacture of artificial stone. July 31.

16,050. C. von Forell. A process for the production of Portland cement from blast furnace slag and lime and the like. Complete Specification. Aug. 5.

16,098. S. Cowper-Coles. Improvements in rendering wood non-flammable. Aug. 8.

16,449. W. Wright. Improvements in the manufacture of blocks of artificial stone and the like. Aug. 12.

Complete Specifications Accepted.

1898.

19,102. W. L. Wise. From F. Boas, Canada. Manufacture of material suitable for wall plaster and similar purposes. Aug. 2.

19,579. J. W. Butler. Magnesian cement applicable for the manufacture of stone, emery, wheels, billiard ball compositions, and for other purposes. Aug. 2.

20,538. W. L. Allcroft. Floor covering. Aug. 2.

24,941. O. Howl. Apparatus for drying bricks or other plastic articles. Aug. 10.

1899.

1573. H. Werths.—From P. Kleber, Germany. Process for the production of building stones, bricks, and like articles. Aug. 10.

12,664. F. C. W. Timm. Rotary or revoluble furnaces or kilns for burning cement, lime, and like materials. Aug. 2.

X.—METALLURGY, MINING, Etc.

Applications.

14,656. O. P. Nauhardt. *See* Class XIII.

15,062. L. M. O. Dessaigne. The manufacture of a new metallic body. July 21.

15,088. W. H. James and C. J. Norris. Improvements in or relating to the treatment of slimes and tailings containing precious metals. July 21.

15,110. J. Baxeres de Alzugaray. Improvements in extracting metals from their oxides and in forming alloys. July 22.

15,121. J. P. van der Ploeg and P. J. Eussen. Improvements for treatment of ores containing antimony with recovery of the valuable contents and combinations. July 22.

15,129. J. Zerzog. Process of enamelling iron and other metals. Complete Specification. July 22.

15,162. T. P. Sims, of J. S. Merry and Co., Swansea. Improvements in the extraction of zinc from ores of a complex character containing also lead. July 24.

15,206. C. G. Meissner and B. Bennewitz. A process for hardening steel. July 24.

15,301. W. J. Worsey. Improvements in treating zinciferous ores containing lead, gold, and silver. July 25.

15,383. A. Darlay. Process to effectuate metallic coatings on small articles by non-electrical way. Complete Specification. Filed July 27. Date applied for, Feb. 14, 1899, being date of application in Germany.

15,402. H. R. S. Coleman and G. Cruickshank. An improved process for removing tin from tinned scrap. July 27.

15,976. A. M. Clark.—From A. E. Savage, New South Wales. Improvements in the treatment of zinc-bearing ores. Aug. 4.

16,026. S. Thompson, J. McEwen, and J. Mees. Improvements in or relating to the process of enamelling. Aug. 5.

16,108. T. Twynam. Improvements in the recovery of tin from tin scrap. Aug. 8.

16,127. W. H. Harrap. Improvements in alloys. Aug. 8.

16,445. C. D. Abel.—From F. Schotte, Germany. Process for carbonising and deoxydising molten metal. Complete Specification. Aug. 12.

Complete Specifications Accepted.

1898.

18,387. A. Gray. Pickling castings. July 26.

18,487. R. R. von Berks and J. Renger. Process for the preparation of composite plates of lead or the like materials. July 26.

19,029. R. W. Davies. Apparatus for casting. July 26.

20,450. O. Elstner. Process for the preparation of metallic oxides. Aug. 2.

20,681. R. W. E. MacIvor and T. F. Spence. Manufacture of sesquioxide of chromium direct from chrome ore. Aug. 2.

21,376. L. Pszczolka and R. M. Daelen. Process for effecting the preliminary refining of pig-iron. Aug. 10.

1899.

6589. R. Fiedler. Process for silver plating. July 26.

10,777. W. J. Patterson and A. M. Acklin. Apparatus for casting slag and metals. Aug. 2.

11,712. R. Tellenka, J. Kolbinger, and S. Hagyiristic. Moulds for casting magnesium compositions and similar cements. Aug. 2.

12,204. J. L. Stevenson and J. Evans. Blast furnace slag ladles. July 26.

12,390. M. B. Ryan. Art of plating and colouring aluminium. Aug. 2.

14,219. H. Theis. Shot-proof armour. Aug. 16.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

6125A. P. M. Justice.—From The Pope Manufacturing Company, United States. Improvements in and relating to secondary batteries. Complete Specification. Filed July 20. Date claimed under Patents Rule 19, March 21, 1899.

14,794. S. Y. Heebner. Improvements in and relating to storage batteries. Complete Specification. July 18.

15,017. H. Weymersch. Improvements in electric accumulators or secondary batteries. July 21.

15,169. B. Kennedy. Improvements in electric storage battery plates. July 24.

15,194. W. B. Bary. Improvements in galvanic cells. July 24.

15,207. P. Neumann. An improved process for depositing and changing metals. July 24.

15,359. C. H. Preston. An improved primary battery for generating electricity. July 26.

15,370. T. de Michalowsky. Improved secondary or storage battery. Complete Specification. July 26.

15,426. A. Tribelhorn. An improved electric battery and process for constructing the electrodes for the same. Complete Specification. July 27.

15,438. E. Frenot. A new or improved electrolytic process and apparatus for the production of chemically pure cupric sulphate and copper. Complete Specification. July 27.

16,040. G. Smith and D. Corrie. Improvements in electric fuses and electric detonator fuses. Aug. 5.

16,175. C. Levetus. Improvements in and relating to electric batteries. Aug. 9.

16,210. S. O. Cowper-Coles. Improvements in the manufacture of thin tubes or sheets of copper or other metal by electro-deposition. Aug. 9.

16,247. A. Smith. A new material adapted for electrical insulation, and also for many purposes for which ebonite, wood, and such like materials are used. Complete Specification. Aug. 9.

16,250. R. M. Sallher. Manufacture of colouring matters and their reduction products by electrolysis. Aug. 9.

16,293. P. J. Davies. Improvements in the manufacture of leaden plates for secondary batteries or accumulators, and in moulds and tools to be employed in such manufacture. Aug. 10.

Complete Specifications Accepted.

1898.

17,741. T. Machin and E. Cake. Electric batteries. Aug. 2.

18,743. J. F. L. Moeller, and E. A. G. Street. Extraction of chromium by electrolysis. Aug. 10.

19,445. H. Blumenberg, jun. Electric batteries. Aug. 10.

21,307. S. Pitt.—From The Pharmaceutisches Institut Ludwig, W. Gans, Germany. Production of incandescent materials suitable for use in electric lighting. Aug. 16.

21,364. H. Blumenberg, jun. Battery solutions. July 26.

24,308. H. J. Haddan.—From Columbus Electrizitäts gesellschaft m. b. H., Germany. Electric batteries. July 26.

1899.

1553. W. M. McDougall. Secondary or storage batteries. July 26.

2629. R. J. Yarnold. Electrolysis or modification of gases and gaseous mixtures or compounds. Aug. 10.

6297. H. Bumb. Apparatus for extracting or reducing metals, or for making metallic alloys by electrolysis. Aug. 2.

10,744. E. L. Lobdell. Storage batteries. Aug. 10.

11,422. J. G. A. Rhodin. Electrolytic apparatus. Aug. 2.

13,732. C. E. Lee. Electrical storage batteries. Aug. 10.

14,300. W. C. Callmann. Primary batteries. Aug. 16.

XII.—FATS, OILS, AND SOAP.

Applications.

15,159. E. G. Scott. Improvements in refining glycerine, and apparatus therefor. July 22.

15,163. J. E. Bedford, C. S. Bedford, and F. Reddaway. *See* Class XIII.

15,330. S. W. Gillett.—From P. Pollatschek, Germany. Improvements in the purification of fats and oils to be used for food or for medical or other purposes. July 26.

15,752. J. Foster. A composition for cleaning papers on walls and ceilings, also distempered and like surfaces. Aug. 1.

15,994. T. Macalpine. Improvements in the refining of oils. Aug. 4.

Complete Specifications Accepted.

1898.

19,085. J. N. Harris and H. S. Headington. Mode of treating edible and other oils. Aug. 2.

19,160. A. C. M. Rieck. Manufacture of cacao butter. July 26.

1899.

11,772. W. Erben. *See* Class V.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

Applications.

14,686. O. P. Nauhardt. A special varnish for aluminium. Complete Specification. Filed July 17. Date applied for Dec. 24, 1898, being date of application in France.

15,163. J. E. Bedford, C. S. Bedford, and F. Reddaway. The preparation of an india-rubber substitute from linseed oil. July 24.

15,255. A. Gentzsch. Manufacture of a gutta-percha like substance. Complete Specification. July 25.

15,310. A. P. Bjerregaard. An improved process for the manufacture of varnish. Complete Specification. July 25.

15,847. H. W. N. Ahrens. A stirring device to overcome the formation of skins or films in the storing or keeping of lacquers, varnishes, oils, colours, and other substances liable to form a skin or film on the top. Complete Specification. Aug. 2.

16,286. H. J. Anderson. Improvements in the manufacture of white lead and apparatus therefor. Aug. 10.

16,455. O. Comuzzi. Improved anti-fouling composition for painting ship's bottoms. Aug. 12.

Complete Specification Accepted.

1898.

20,044. J. Deborde. Artificial rubber. July 26.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

Applications.

14,775. C. S. Dolley and A. F. Crank. An improved process of tanning. Complete Specification. July 18.

15,554. F. Huff. Improved process for the manufacture of white gelatine. July 29.

15,652. H. H. Lake.—From Gerberei-Gesellschaft mit beschränkter Haftung, Germany. An improved process of continuous tanning. July 31.

Complete Specifications Accepted.

1899.

5822. L. Beeck. Process for manufacturing size powder. Aug. 10.

13,357. G. S. Wolff. Enamelled leather and enamel for producing the same. Aug. 10.

XV.—AGRICULTURE AND MANURES.

Application.

15,543. W. Diamond. Apparatus for clarifying spent liquor from sulphate ammonia plant. July 29.

XVI.—SUGARS, STARCHES, GUMS, Etc.

Applications.

15,451. E. Kafka. A process for purifying molasses for use in the manufacture of pressed yeast. July 27.

15,815. H. Fischer. A process of and apparatus for obtaining ammonia and its salts from the spent liquor of molasses in sugar factories and from vinasse. Complete Specification. Aug. 2.

Complete Specification Accepted.

1898.

18,650. J. Evershed. Adhesive substance or gum, and process for the manufacture thereof. Aug. 16.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

15,030. R. Fallnicht. Process for solidfying spirits. Complete Specification. July 21.

15,451. E. Kafka. *See* Class XVI.

15,945. J. D. Morrison. Improvements in stills. Aug. 4.

16,159. E. Barbet. Improvements in or relating to fermentation processes. Complete Specification. Aug. 8.

16,223. E. Barbet. Improvements in industrial distilling and apparatus therefor. Complete Specification. Aug. 9.

16,234. E. Barbet. Improvements in or relating to the production of rum. Complete Specification. Aug. 9.

16,347. R. D. Bailey. Combined mashing, wort boiling, and wort cooling metal cylindrical machines jacketed for the circulation of steam and cold water, and intended for brewers' and distillers' use. Aug. 11.

16,443. F. Thatcher. Brewers' and distillers' wort. Complete Specification. Aug. 12.

Complete Specifications Accepted.

1898.

20,238. J. Hall. Steam circulating arrangement and apparatus for heating brewing pans and the like, and returning water of condensation to boiler. Aug. 10.

1899.

11,107. J. T. Knowles.—From J. A. Bryan and C. H. Boone, United States. Method or process of improving alcoholic liquor. Aug. 2.

14,150. A. Grauaug and J. Krauz. Process and apparatus for accelerating alcoholic fermentations, and at the same time obtaining pure carbon dioxide. Aug. 16.

XVIII.—FOODS, SANITATION, Etc., and DISINFECTANTS.

Applications.

A.—Foods.

14,709. P. A. Chalas. A process and apparatus for the preservation of food. July 17.

14,949. H. O. Blaker. Improvements in and relating to sterilisers for milk and other fluids. July 20.

15,524. A. Dubuisson. Process and apparatus for sterilising natural and artificial butter. July 28.

15,643. B. J. B. Mills.—From H. Bourne, France. A new or improved alimentary product. July 31.

15,955. J. Sleeman and S. White. Improvements in or relating to the production of alcoholic liquors flour or meal and malted or readily digested foods. Aug. 4.

B.—Sanitation.

15,457. S. I. Adams. Improvements relating to the treatment of sewage, and to apparatus therefor. July 27.

15,755. A. E. Bréchot. Apparatus for the destruction of solid sewage and other matters. Aug. 1.

15,765. C. J. Whittaker. Improvements in the purification or treatment of sewage by the biological or bacterial method. Aug. 2.

15,784. P. Schreck. Improvements in water purifiers. Complete Specification. Aug. 2.

16,066. Siemens Bros. and Co., Ltd.—From Siemens and Halske Aktien Gesellschaft, Germany. Process for purifying water by the joint action of iron and ozone. Aug. 5.

16,211. F. Dawes. Improvements in or relating to the treatment of sewage and the like. Aug. 9.

Complete Specifications Accepted.

A.—Foods.

1898.

19,705. Société "le Lait" Process and Apparatus for sterilising and preserving milk. Aug. 16.

1899.

12,992. F. Cowin. Preservation of meat. Aug. 2.

13,744. W. Lanwer and E. Rüping. Process of preserving perishable food and other materials against infection, atmospheric and other influences. Aug. 10.

B.—Sanitation.

1898.

16,217. F. M. Spence and D. D. Spence. Treatment of sewage. Aug. 2.

19,782. Maiche, Ltd.—From L. Maiche, France. Apparatus for sterilising water. Aug. 16.

20,118. R. H. Reeves. Method of effecting the purification of sewage effluents, and in appliances employed therewith and therefor. Aug. 10.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

15,355. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of a celluloid like substance. July 26.

15,529. J. O. Klimsch. Process and apparatus for the manufacture of long-staple wood pulp. July 28.

15,748. W. L. Wise.—From Hoffnungsthaler Papierfabrik A. and R. Geldmacher, Germany. Improvements in the manufacture of paper. Aug. 1.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Applications.

15,208. E. Erdmann. Manufacture of isatoic acid. July 24.

15,886. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of chemical compounds from halogenphtalimides. Aug. 3.

16,017. W. J. Clapp. Improvements in the manufacture of extracts and essences from meat and poultry, and in the apparatus and receptacles for use in the production of the same. Aug. 5.

16,231. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. Improvements in the manufacture or preparation of derivatives of (3^1) hydroxy-caffeine. Complete Specification. Aug. 9.

16,296. C. Goldschmidt. The manufacture of a product from formaldehyde and phenol. Aug. 10.

16,353. G. W. Johnson.—From Kalle and Co., Germany. The manufacture and production of a new compound of iodol and albumen. Aug. 11.

Complete Specifications Accepted.

1898.

16,965. L. Lilienfeld and F. Silberstein. Process for the synthetic production of proteids or of compounds having the chemical properties of proteids. Aug. 16.

17,303. W. P. Thompson.—From J. U. Kreis, Germany. Process for producing pyrotartaric diphenylester as a preparation for medicinal purposes. Aug 2.

18,050. E. Kander. Method of manufacturing methyl morphine (codeine) and ethyl morphine. July 26.

19,823. J. T. Hewitt. Manufacture of a new product from piperidine. Aug. 2.

1899.

1678. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. Manufacture or preparation of alkylised uric acids. Aug. 10.

11,420. C. D. Abel.—From B. Jaffé and Darmstaedter Lanonlinfabrik, Germany. Manufacture of piperazine quinate, and quinates of piperazine derivatives and their alkali salts. Aug. 10.

XXI.—PHOTOGRAPHY.

Applications.

15,096. A. M. Barnes and E. Cowper. Improvements in animated photography and in apparatus connected therewith. July 22.

15,141. W. N. L. Davidson. Improvements in colour photography. July 27.

15,861. G. J. Sershall and A. F. Biddle. An improved form of coloured photography to be used for ornamental or decorative purposes. Aug. 3.

15,864. G. J. Sershall and A. F. Biddle. An improved actinometer for photographic use. Aug. 3.

16,292. G. T. Holloway. A new or improved photographic printing process. Aug. 10.

Complete Specification Accepted.

1898.

21,595. C. D. Abel.—From The Actiengesellschaft für Anilinfabrikation, Germany. Photographic developers. Aug. 16.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

15,256. A. Luck. An improvement in the manufacture of explosives. July 25.

15,850. S. A. Rosenthal. Improvements in matches and processes for the manufacture thereof. Aug. 2.

16,040. G. Smith and D. Corrie. *See* Class XI.

Complete Specifications Accepted.

1898.

17,957. P. Ward. Igniting composition to be employed in the manufacture of matches. Aug. 10.

19,074. W. H. Cromie. Manufacture of explosives. Aug. 10.

1899.

8767. A. J. Boult.—From E. Grimont, France. Manufacture of matches. Aug. 10.

12,147. H. P. Hurst. Explosive shells and fuses, and fillings for exploding or detonating the explosive. Aug. 10.

XXIII.—ANALYTICAL CHEMISTRY.

Applications.

15,665. D. Hutchinson. An improved method and apparatus for sampling milk and other liquids. July 31.

16,185. The Dairy Outfit Company, Ltd., and W. T. Webster. Improvements in apparatus for testing milk and other substances. Aug. 9.

PATENTS UNCLASSIFIABLE.

Application.

16,378. E. Dowie and The Faramel Manufacturing Company, Ltd. Composition of matter. Complete Specification. Aug. 11.

Complete Specifications Accepted.

1898.

19,689. G. G. Smith and M. Stuart. Manufacture of fluid-proof articles. July 26.

1899.

9687. J. D. Morck. Process for preserving hygroscopic and decomposable substances, and rendering them suitable for transport. July 26.

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Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—p. 7912.

THE JOURNAL

OF THE

Society of Chemical Industry.

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 9.—Vol. XVIII.] SEPTEMBER 30, 1899. [Non-Members 30/- per annum: Members 21/- per Set of extra or back numbers: Single Copies (Members only) 2/6.

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NOTICES.

Collective Index.

The Collective Index (1881—1895) is now ready. The prices are as follows:—

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Hurter Memorial Lecture.

This lecture will be delivered by Prof. G. Lunge, Professor of Technological Chemistry at the Polytechnic, Zürich, on "Impending Changes in the General Development of Industry, and particularly in the Alkali Industries," in the Theatre of the Chemical Department, University College, Liverpool, on Wednesday, October 4th, at 8 p.m.

Notice is hereby given, for the information of members and advertisers, that the advertisement columns of this Journal have been contracted for by Messrs. Eyre and Spottiswoode, the Society's printers and publishers, to whom all communications respecting them should be addressed. The circulation of the Journal is now more than 3,500 per month.

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LIST OF MEMBERS ELECTED 25th APRIL 1899.

Erratum.

"Labriskie, Christian B.," should read "Zabriskie, Christian B.," and order in list altered accordingly.

Deaths.

Dale, Richard S., 1, Chester Terrace, Old Trafford, Manchester. July 6.

Harkness, Wm., at Brodick, Arran. Sept. 5.

Weldon, Ernest, Egypt Road, New Basford, Nottingham.

London Section.

THE LIFE-WORK OF ALFRED NOBEL.

BY HENRY DE MOSENTHAL, F.I.C.

(This Journal, May 1899, 443—451.)

Erratum.

On p. 448, col. 1, line 16 from top, for "B. H. Beckett" read "G. H. Beckett." The Society is indebted to Mr. G. H. Beckett for the photograph of the late Alfred Nobel from which the photogravure in the June number was prepared.

Obituary.

A. SCHEURER-KESTNER.

Member of the Society of Chemical Industry.

Former Vice-President of the Senate of the French Republic, &c.

This veteran Chemical Technologist was born in 1833, at Muhlhausen, in Alsace. He studied chemistry in the Quartier Latin, in Paris, and later on returned to Thann, where he married the daughter of M. Charles Kestner, a wealthy size manufacturer, and after the death of his father-in-law in 1870, he undertook the management of the works on behalf of his wife and her sisters. He thus eventually became a leading shareholder and the managing director of the Société Anonyme des Fabriques de Produits Chimiques de Thann (formerly Charles Kestner and Co.). He was also one of the founders of the Société Industrielle de Mulhouse.

In 1870, Scheurer-Kestner was the manager of a Pyrotechnic Establishment at Cette, and in 1871 he became the representative in the French Senate of the Upper Rhine. In 1875, he was elected a life Senator, and became a Vice-President of the Senate. M. Scheurer-Kestner was much esteemed in the Senate, even by his adversaries, who recognised the loyalty of his character and his sturdy honesty.

He has been President of the Société Chimique de Paris, and was a member of the Council of the Conservatoire des Arts et Métiers. He was also for some years political editor of the ***République Française***, and was author of several works on Chemistry and the allied branches, as well as being an investigator of great repute.

During the sixties, he published a book on the "Elementary Theory of Types applied to Organic Compounds."

With regard to Scheurer-Kestner's many contributions as an investigator, principally in connection with Applied Chemistry, a survey of these during the last 30 years shows that the principal subjects covered in these experimental inquiries are:—The Alkali and Sulphuric Acid manufacture. Coal: its heat of combustion and calorific value; its destructive distillation, and the transformation of its nitrogen. Fuels for steam boilers. Loss of heat in steam boilers. Heat of combustion of coal. Investigations of Turkey-red oil. Polymers of Ricinoleic Acid, &c. References to these numerous investigations will be found in the Collective Index of the J. Chem. Soc. 1873—1882, and in the Collective Index of this Journal (1882—1895), under the name of their author.

It is worthy of note that, following our Great Exhibition of 1862, when Professor A. W. Hofmann drew up his invaluable report, M. Scheurer-Kestner assisted in this work as collaborateur. It may also be mentioned that he had been a member of the Society of Chemical Industry from its commencement until the end of last year, when he withdrew, owing to general breakdown of his health. He died Sept. 19th, at Bagnères-de-Luchon, of typhoid fever after a comparatively short illness, aged 66 years.

WILLIAM HARKNESS.

Member of the Society of Chemical Industry.

Formerly a Superintending Analyst of the Inland Revenue Branch of the Government Laboratories.

William Harkness was born in Edinburgh, March 30, 1834. In 1857 he entered the Inland Revenue outdoor service, in 1860 being appointed a student in the Government Laboratory, and in 1867 he was promoted to be an analyst on the permanent staff. In spite of feeble health he continued to progress, and in 1884 he was appointed a superintending analyst, holding that office until his retirement on June 15, 1897. During the thirty-seven years he was connected with the Somerset House Laboratories, Mr. Harkness was employed in many kinds of work. He made a special study of microscopy, particularly in connection with the microscopic characters of the various starches and vegetable substances likely to be used in adulterating tobacco and snuff, and he at length became a recognised authority, not only on the examination of tobacco, but on that of coffee, pepper, mustard, and other articles liable to adulteration with vegetable substances. He was employed also for many years in instructing assistant supervisors in the use of the microscope. He was always ready to assist his colleagues of the Government Laboratory, and freely placed his experience and skill at their service, whilst his kindly nature and disposition endeared him to all.

He was a Fellow of the Royal Microscopical and Chemical Societies, and of the Institute of Chemistry, and in 1887 he was elected a member of the Council of the Institute. Mr. Harkness devoted much attention to the subject of concentrated foods, and was of great service to Dr Nansen when he was preparing for his Polar expedition. He was a member of the Society of Chemical Industry from its commencement. His death occurred on Sept. 5th.

Journal and Patent* Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Gases, Impts. in Apparatus for Measuring and Indicating the Pressure of. M. Arndt, Aachen, Germany. Eng. Pat. 21,797, Oct. 17, 1898.

The apparatus consists of two vessels rigidly connected by a tube at their lower ends, and attached to a balance, the knife edge of which is located between the two vessels, as near as possible to the centre of gravity of the apparatus in the position of the state of rest. The vessels are supplied with liquid up to a certain height, one vessel being open to the atmosphere, and the other in communication by a tube, with the reservoir or space containing the gas, the pressure of which is to be measured. The variations of the liquid levels, and also the position of the state of rest, are indicated by scales on the apparatus.—R. A.

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* Any of these specifications may be obtained by post by remitting 8*d*.—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

Hygroscopic and Decomposable Substances, Process for Preserving, and Rendering them suitable for Transport. J. D. Morck, Stassfurt, Saxony. Eng. Pat. 9687, May 8, 1899.

The substance is mixed with a non-hygroscopic body, such as fat, oil, petroleum, or the like, and is then incorporated with a material, like infusorial earth, which will render the mixture loose or porous. Or, the non-hygroscopic substance may be first mixed with the "loosening material" and the mixture incorporated with the decomposable body. Or, in place of either of these, a natural substance which is both loosening and non-hygroscopic may be employed, such as, for instance, soot, powdered lignite, coal, and the like—say in the proportion of from 6 to 8 per cent.

It is stated that the particles of the decomposable substance thus treated, remain in close contact with those of the non-hygroscopic substance, and are not removed by any friction to which the mass may be subjected.—C. A. M.

Fire Extinguishers, Impts. in and relating to Chemical. W. H. Douglas, Washington, U.S.A. Eng. Pat. 12,334, June 13, 1899.

The extinguisher consists of an alkali reservoir provided with a suitable delivery nozzle, and an acid bottle immovably mounted near the top of the reservoir. The bottle is provided with a hollow movable plug, having lateral openings, through which the acid is discharged into the reservoir when the extinguisher is inverted. A vent space, normally closed by the supporting flange of the plug, is provided between the neck of the bottle and the plug, and is opened and closed by the movement of the latter.—R. A.

Closing Device for Receptacles having Capillary Openings for the Transport, Storage, and Use of Volatile Liquids. C. D. Abel, London. From Dr. Zimmermann, Lüthy and Co., Aargau, Switzerland. Eng. Pat. 12,611, June 16, 1899.

The claim is for "a closing device for a receptacle with a capillary opening, for containing volatile liquids, consisting of the combination of a ring-shaped caoutchouc band having a button-hole opening, and a nozzle having a swelling or button at a short distance from its capillary opening, the band being fitted with its button hole over the said swelling, and having its other part stretched over the capillary opening."

II.—FUEL, GAS, AND LIGHT.

Coal Dust and Coal-Dust Slimes, Utilisation of. Oesterr. Zeits. für Berg und Hüttenwesen, 1899, 127. Proc. Inst. Civil Eng. 1899, 63.

The methods which have been hitherto proposed for the utilisation of the fine coal dust separated by dry sifting, and from the mud deposited in the clarifying ponds of the "coal washeries," require the fuel to be artificially dried, and have not proved to be practically available. A new method has recently been introduced by Bechem and Post, which dispenses with any preliminary treatment, the dust being taken directly from the screens, and the pond slimes when only superficially dried. In this condition, the former contain 26—28 per cent. of ash and 7·5 per cent. of water, and the latter about 30 per cent. of ash and 19 per cent. of water. The dust and slimes can be burned in Lancashire boilers by aid of an air blast introduced under the grate through a water "pulveriser" or trompe worked at a pressure of not less than four atmospheres, the velocity of the air current being sufficient to set the bed of fuel in motion and burn the finely divided carbonaceous matter while in suspension, giving a large body of flame, whilst the grate bars are scarcely red hot. The water, which drains back through a collector in the ash-pit, may be used for condensing purposes or for feeding boilers. The labour in stoking and cleaning fires is about double that required with ordinary coal, and if a natural head of water be not available, a force pump must be provided to give the necessary pressure; but notwithstanding this, the saving in cost, owing to the nearly waste character of the fuel, is stated to be very considerable, amounting with "washery slimes" to 31·9 per cent., and with "third-class slack" to 26 per cent.

The slime can either be burned alone, in which case it must be slightly damped before firing, or, preferably, it can be mixed with dry dust.

Comparative trials made at the Malstatt Waterworks, Saarbrücken, showed that the steam-raising power of the boilers was much improved, the hourly production of steam per square metre of heating surface being increased from 12·22 kilos. with round coal to 18 kilos. with dry coal dust, the evaporative factor of the former being 8·05, and of the latter, 4·735, whilst the consumption was in the proportion of 100 to 230.—A. S.

Tar Thickening [in Gas Plant], Prevention of. G. Liegel. J. für Gasbeleucht. 1899, **42**, [32], 521—526.

With the introduction of generator furnaces in retort settings, the heats of the retorts were increased, and the tar formed became thereby thick and less oily, and caused blockages of the ascension pipes, hydraulic main, &c. The author experienced much trouble from such causes when he was first carbonising English coal in retorts with generator firing, and he tried many expedients for avoiding the thickening of the tar, without avail. A remedy which proved satisfactory was the admixture of a proportion of Upper Silesian or Saar coal, either of which yields a very freely fluid tar even at high heats, with the English coal. The thin tar from the German coal then kept the thick tar from the English coal in a sufficiently oily or fluid state. The author, however, proceeded to investigate the causes of the thickening of the tar produced from English coal. He found it to be due to overheating of the coal and gas and tar produced. In order to avoid it, he found that the retort settings should be so constructed that (1) the retorts are not unevenly heated; (2) the gas is vigorously cooled on its way from the retorts; (3) the hydraulic main and collecting main can be readily opened for the removal of obstructions; and (4) the depth of the hydraulic dip is kept uniform; while the man in charge of the works should take care that (1) a rake or other tool is used to level the charge on the bottom of the retort, so that it is of uniform thickness; (2) the period of carbonisation is long; (3) the retorts are not freed from scurf (retort-carbon) in too rapid succession; (4) the heat of the setting is not excessive; (5) the make of gas per charge of coal is prescribed, and the make actually secured, recorded; and (6) the ascension pipes are cleansed once in 48 hours.

The author found that the quality of the tar was unaffected when the make of gas was increased from 29 to 31 cb. m. per 100 kilos. of coal, but with a make of 32 cb. m., the tar and the illuminating power of the gas both showed signs of deterioration, and with a make of 33 cb. m. both were very bad. He therefore concluded that for the coals in question, 31 cb. m. per 100 kilos. was the maximum make consistent with the production of gas and tar of good quality. During the last working year he was able to secure an average make of 30·9 cb. m. at the Stralsund Gasworks. He prefers flat-bottomed retorts, 630 mm. wide, 350 mm. high, and 2,900 mm. long, which take a maximum charge of 210 kilos. of coal. He found that four charges per retort per 24 hours could be carbonised, and a tar of good consistency obtained.—J. A. B.

Carbides, Classification of the: their Modes of Formation and Reactions of Decomposition. J. A. Mathews. J. Amer. Chem. Soc. 1899, **21**, 647—650.

A list is given of all the known metallic carbides, classified according to their methods of formation and to their decomposition by water or hydrochloric acid.

Reactions of Formation.—(1.) By heating metallic oxides or carbonates with carbon in the electric furnace. In this way are formed the carbides of lithium, calcium, aluminium, barium, beryllium, boron, cerium, lanthanum, manganese, molybdenum, silicon, strontium, thorium, titanium, tungsten, uranium, vanadium, yttrium, and zirconium.

(2.) By heating directly the metal with carbon either in the electric furnace or at a lower temperature. This method holds good with potassium, aluminium, boron, chromium, silver, copper, nickel, and iron.

(3.) By decomposing certain organic compounds by heat.

(*a.*) Thiocyanates of silver, bismuth, copper, iron, manganese, lead, tin, and zinc, when heated in absence of air, are said to decompose thus: $Fe(CNS)_2 = FeC + CS_2 + N_2$.

(*b.*) Certain salts of organic acids yield the corresponding carbides on heating:—

$Ce(COOH)_2$ or CeC_2O_4 gives CeC_3.
$C_6H_4(C_3H_7)COOAg$ gives Ag_2C?
$CH_3.CO.COOAg$ or $C_2H_2(COOAg)_2 = Ag_2C_2$.
$Co_2O_3 + KHC_4H_4O_6$ gives cobalt carbide?

(*c.*) Action of heated metals on hydrocarbons:—

$C_2H_2 + Na = C_2HNa$.
$C_2H_2 + 2Na = C_2Na_2$.

Similar compounds are formed with potassium and magnesium. Silicon and magnesium give with benzene vapours, SiC_2 and MgC_2?

(4.) Acetylides are formed by passing acetylene through ammoniacal solutions of silver nitrate, cuprous chloride, and aurous thiosulphate, or over freshly precipitated mercuric oxide.

(5.) The carbides of silicon, titanium, tungsten, &c., are formed by reducing the oxides by means of calcium carbide.

Reactions of Decomposition.—(1.) The carbides of lithium, sodium, potassium, calcium, barium, and strontium are decomposed by water, giving mostly acetylene.

(2.) Silver, copper, mercury, and gold (?) acetylides are acted on by hydrochloric acid, giving acetylene.

(3.) Aluminium and beryllium carbides react with water, yielding methane.

(4.) Manganese carbide with water gives methane and hydrogen.

(5.) The carbides of yttrium, lanthanum, and thorium are decomposed by water, giving mixtures of acetylene, ethylene, methane, and hydrogen.

(6.) Lanthanum, cerium, and uranium carbides give with water, besides the volatile products, a residue of liquid and solid hydrocarbons.—T. H. P.

Calcium Carbide, The Power required for the Production of 1,000 *kilos. of, and the Cost with different Sources of Power.* F. Liebetanz. Zeits. für angew. Chem. 1899, [28], 658—659.

The author compares the prospects of steam and blast-furnace gas with waterfalls, as sources of power for the production of carbide. He states that in practice 3·68 kilos. of carbide can be produced per effective horse-power in 24 hours, and that therefore 272 effective horse-power is required at the electrodes of the furnace to produce 1,000 kilos. per 24 hours. Allowing for losses, and taking an efficiency of only 75 per cent. in the electrical plant, 450 horse-power would be needed to produce this. The cost by water-power would be 13,500 marks per annum, and from steam, with brown coal at 3 marks per (metric) ton, 21,294 marks, or with coal at 9 marks per ton, 23,340 marks. Carbide has, in one district where water power was not obtainable, been produced by steam power at a total cost of 234 marks per metric ton, while the freight to that district of carbide produced by water power amounted to 58 marks per ton. Therefore the net cost of the latter carbide would have to be not more than 176 marks per ton in order that it might compete with the former in the district. In such cases, carbide might be produced by steam power to supply local needs. Factories at present using power in the day only, might advantageously adopt carbide manufacture at night. Blast-furnace gas has a high duty in suitable gas engines, and the blast furnaces of Germany and Luxemburg, on the basis of their 1897 production of crude iron, would be capable of furnishing 87½ million horse-power at a very low cost. The power of rivers can be utilised, but at an efficiency of about 50 per cent.; hence 540 horse-power would be required to furnish 272 at the electrodes. The cost would be 74 marks per effective horse-power per annum.—J. A. B.

Calcium Carbide and Acetylene, Impurities in. N. Caro. Zeits. angew. Chem. 1899, [28], 661—663.

Sulphur, phosphorus, and nitrogen are the elements responsible for the impurities. Sulphur occurs in carbide as calcium sulphide and carbosulphide and aluminium sulphide. Calcium sulphate in the lime, and sulphur in the carbon used in the manufacture, produce the first two impurities, and alumina and sulphur in the raw materials the last impurity. All three may be diminished in quantity if an excess of carbon be used in the manufacture, as they are thereby split up to carbide and sulphur or sulphurous or sulphuric acid. In generators in which the temperature remains low, the sulphuretted hydrogen which these impurities liberate is retained by the lime sludge, but if the temperature become high, it reacts and forms organic sulphur compounds, of which the author recognised mercaptan and mustard oil, which then occur in the acetylene along with some unchanged sulphuretted hydrogen. Phosphorus occurs in carbide as calcium phosphide, and results from phosphorus compounds in the raw materials. If, however, an excess of carbon be used in the manufacture of a carbide, calcium phosphide is decomposed to phosphorus, which volatilises, and calcium carbide, and it is thus possible to produce from raw materials rich in phosphorus, a carbide which contains little phosphorus. Calcium phosphide yields with water phosphuretted hydrogen, but the author concludes from a number of researches that the phosphide which is found in carbide does not yield spontaneously inflammable phosphuretted hydrogen. The heat of its oxidation may, however, suffice to ignite a mixture of acetylene and air. When the temperature at which acetylene is generated is low, nearly pure phosphuretted hydrogen is found in the gas; when it is high, organic phosphorus compounds also occur. In a generator in which carbide was dropped into water, 82 per cent. of the phosphorus was found as phosphuretted hydrogen, and 0·2 per cent. as organic compounds in the gas, while 17·8 per cent. (by difference) was in the residue; but in a generator in which water dripped on to carbide, 52·2 per cent. occurred as phosphuretted hydrogen, 14·3 per cent. as volatile and 2·1 per cent. as non-volatile organic compounds, while 31·4 per cent. (by difference) remained in the residue. Thus the total quantity of phosphorus in the gas was greater with the first class of generator, but the second class yielded more of the organic phosphorus compounds which are only removed with difficulty. Nitrogen occurs in carbide as calcium nitride, which arises from the nitrogen in the carbon used in the manufacture. It yields ammonia with water. The author concludes from numerous researches that fusion of carbide does not produce cyanide, and that calcium cyanide can only arise by the action of the air on the surface of carbide during cooling. In generators in which carbide is dropped into water, 90 per cent. of the ammonia is retained by the latter, but in generators in which water drips on to carbide, condensation products are formed with the sulphuretted hydrogen, phosphuretted hydrogen, and acetylene. Carbonic oxide sometimes is found in acetylene to the extent of 2·3 per cent., and appears to be due to the purifying material used.

Three methods of purification are available. The first is Wolff's improved process with chloride of lime, which was first suggested as a suitable agent by Lunge and Cederkreutz. Ammonia must first be removed from the gas in order to preclude formation of nitrogen chloride. Sulphur and phosphorus compounds are completely removed by this process, but the acetylene is attacked, and chlorine compounds and carbonic oxide are imparted to the gas in inconsiderable amount. The second method is by Frank's process with acid solutions of metallic salts, such as cuprous chloride (dissolved in HCl). All the impurities are removed, and the acetylene is not attacked. One litre of the solution purifies 14 to 16 cb. m. of gas, and, after regeneration, a further 7 to 8 cb. m. if the solution is used in a washer, but better results may be obtained in a scrubber. There is no danger of explosion, provided the solution is strongly acid. "Frankolin" is the commercial name for kieselguhr saturated with Frank's solution. The third method is by Ullmann's process with a solution of chromic acid in sulphuric acid. It gives good results. "Heratol" is the commercial name for kieselguhr saturated with Ullmann's solution. Frank's and Ullmann's processes purify acetylene, so that metal burners which are corroded in a short time by unpurified gas, and in eight weeks by gas purified by Wolff's process, are in faultless condition after 12 weeks' use. Purification by paraffin or other hydrocarbon oils, proposed by Stern, may supplement the other processes, as it removes any sulphur and phosphorus compounds which they do not abstract.—J. A. B.

Acetylene, Purification of. F. Ahrens. Zeits. für angew. Chem. 1899, [28], 660—661.

A material for the purification of acetylene should quantitatively decompose, or remove from the gas, phosphuretted hydrogen, sulphur compounds, ammonia, and amines, and should not attack the acetylene, causing a loss thereof or forming volatile products to contaminate the gas; moreover, it should be cheap, readily obtainable, and free from danger in use. Lunge and Cederkreutz' reagent is referred to (see preceding abstract). Wolff uses a mixture of chloride of lime and lead chromate. The author has not found the chromate in the material to be of any value. He found that 1 kilo. of Wolff's material freed 18 cb. m. of acetylene from all sulphur and phosphorus compounds, but organic chlorine compounds and carbonic oxide contaminated the gas which had been treated. A. Frank uses the solution described in the preceding abstract. The author found that 1 kilo. of Frank's material purified 5 cb. m. of acetylene, and that all the impurities were removed by it, and the acetylene unaffected, but that a certain amount of gas was retained owing to the formation of a double compound, $C_2H_2Cu_2Cl_2$. As regards Ullmann's purifying material, the prepared kieselguhr is bright yellow, and becomes a dirty green when exhausted by use, but regains its original colour on exposure to the air. It oxidises the impurities and gives good results. Bunte and Wachs found that 1 cb. m. of crude acetylene was purified by an expenditure of 5·5 grms. of chromic acid.
—J. A. B.

Sulphur, Total, in Coal; Estimation of. U. Antony and A. Lucchesi. Chem. Zeit. Rep. 1899, **33**, 175.

See under XXIII., *page* 866.

PATENTS.

Combustible Liquids, Improved Means for Atomising and Diffusing. P. M. A. Drouot, Cherbourg. Eng. Pat. 17,751, Aug. 17, 1898.

The combustible liquids are heated and then atomised or diffused by their own vapour. The means employed for this purpose consist of "a vessel in which the oil is superheated and which is connected to any suitable atomising or diffusing apparatus by means of two pipes, one pipe leading from the bottom of the said vessel to the diffusing apparatus for conveying the superheated oil into the said diffuser, and the other pipe leading from the upper part of the said heating vessel for the purpose of conveying the combustible vapour to the diffusing apparatus." In another form, the means comprise "a boiler, in which the combustible liquid is vaporised as it is introduced, the vapour so obtained passing to a diffusing apparatus, where it atomises or diffuses the combustible liquid admitted thereto from a point rearward of the boiler."—R. S.

Fuel, Liquid, into Furnaces; Impts. in Apparatus for Feeding. E. A. Vétillard and E. Scherding, junr., Paris. Eng. Pat. 8589, April 25, 1899.

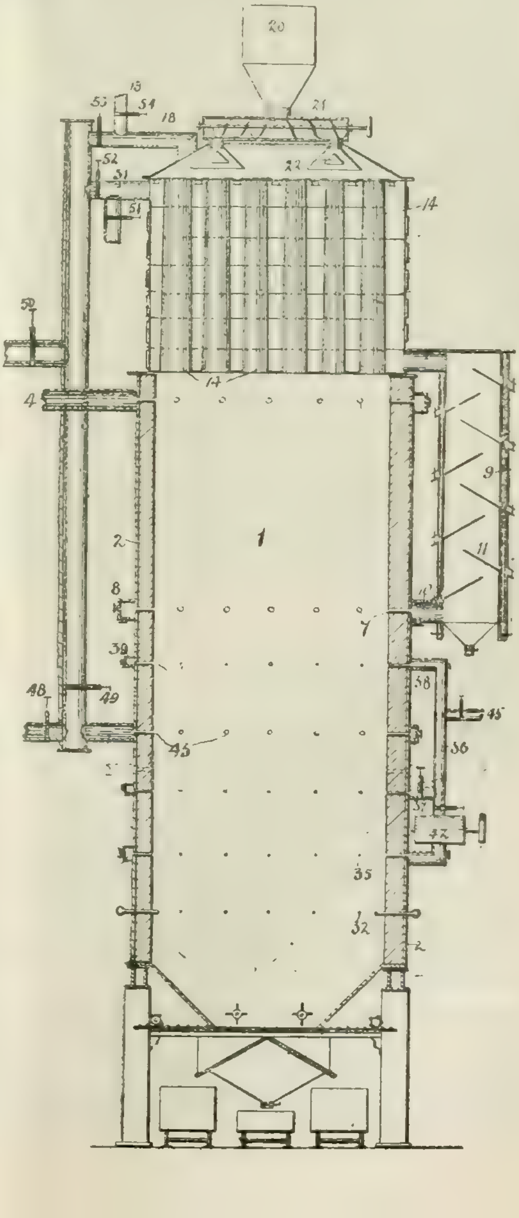
The claim is for a mixing jet, the first injector of which draws up the fuel, mixes it with steam, and ejects it in the form of a cylindrical stream or jet, whilst the other two injectors, which are co-axial, convert this cylindrical jet into an annular one "held between two layers of air, the one interior and the other exterior, whereby the fuel, steam, and air are thoroughly mixed together." In connection with the jet is a sieve for straining the fuel.—C. S.

Fuel Blocks, Impts. in Manufacturing Agglomerated. A. D. de Micheroux, Namur, Belgium. Eng. Pat. 11,169, May 29, 1899.

The fuel is composed of purified gas-tar (or other "liquid hydrocarbons") mixed with soda lime previously submitted to the action of electrified air, resin, and "any agglomerable matters" (coal dust, &c.).—C. S.

Coke, Gas, and By-products; Process and Apparatus for Producing. P. Naef and R. S. Garton, New York, U.S.A. Eng. Pat. 13,164, June 13, 1898.

In the form of apparatus shown, fuel is fed from a hopper, 20, by means of conveyors, 21, and distributing cones, 22, into the vertical pipes, 14. In these pipes the fuel is heated, and illuminating gas passes off through the pipe, 18. The coke which forms, breaks up and falls into the shaft, 1, enclosed in an iron casing, 2. The hot gases from an oil furnace are admitted through the pipe, 4. The oil furnace used may consist of a fire brick chamber encased in iron, and provided with perforated arches, into which it is admitted at the lower part thereof through a spray nozzle, while in front of the burner there is a vertical fire-brick partition to prevent the flame striking the lining of the furnace directly. Such an oil furnace is illustrated in the



patent. After entering the furnace, 1, the gases pass downwards, and fuel gases, containing ammonia and only a small amount of tar vapours, leave by off-takes, 7, annular channel, 8, and tube, 10, to a dust chamber, 9, having inclined withdrawable shelves, 11, forming a zig-zag passage. They then pass to zig-zag passages surrounding the tubes, 14, thereby heating the incoming fuel, and being themselves cooled ere they pass to the outlet, 31. They then pass to a washer and exhauster. The coke descends further in the column, and is exposed to the action of steam, which may be introduced through a tube, 45, and inlet pipes, 37 and 38. Or the steam may be obtained in a lower part of the column by injecting water at 32, and withdrawing the steam by a blower, 42 and 35. In either case, the water-gas produced by the action of the steam is drawn off at intermediate outlets, 43, and can be separately treated for the recovery of ammonia, or it may be mixed with the other gases, valves 48, 49, 51, 52, 53, and 54 admitting of many variations in the treatment of the gases obtained from the different parts of the apparatus. The coke is withdrawn through a funnel-shaped bottom, at the base, in which are mechanically operated sliding doors, beneath which are inclined screens delivering the coke to different trucks according to its size.
—R. S.

Coke, Gas, and By-Products; Process and Apparatus for Producing. P. Naef and R. S. Garton, New York, U.S.A. Eng. Pat. 13,165, June 13, 1898.

The process consists of four steps:—1st. The fuel or coking material is partially coked in pipes. 2nd. The coking operation is completed by passing hot gases through the partially formed coke. 3rd. Ammonia is recovered by passing steam, which is formed by injecting water over the coke, thereby also cooling the latter. 4th. The finished coke is discharged, screened, and loaded into trucks. The apparatus is very similar to that described in the preceding patent. In addition a scraping arrangement is provided to the upper vertical pipes, consisting of suspended sets of vertical or inclined blades encircling the pipes, said set of blades having a reciprocating movement. The object of these blades is to prevent soot and tar forming on the pipes and thereby reducing the transmission of heat.—R. S.

Furnace, Smokeless. C. Timmann, Hamburg, Germany. Eng. Pat. 10,787, May 23, 1899.

This furnace, having an ordinary flat grate, is arranged so that the fire-box or front end of the flue is provided "with longitudinally extending lateral pockets" and external constrictions just above such pockets "for the purpose of forming channels through the pockets clear of the fuel, serving as passages for the hot gases, and by the constrictions affording a lateral support for the fuel and acting so as to cause the hot gases to pass through corresponding apertures in the fire bridge above the grate but below the constrictions."—R. S.

Coke Ovens, Impts. in, and Method of Operating the same. F. W. C. Schniewind, Massachusetts, U.S.A. Eng. Pat. 13,325, June 27, 1899.

The gases, of varying richness and value, given off at different stages of the coking operation are collected separately by means of exhausting devices working at different pressures. The coke is quenched whilst still in the ovens, and the heat of the coke is used for the manufacture of water-gas and for the carburetting of that portion of the water-gas which is, on generation, of sufficient heat to crack hydrocarbon oils. Each charge is subjected to the coking heat by conduction from without. The closed externally-heated coke ovens have separate gas mains provided with valves so that the mains may be connected or disconnected from the oven. Each main has a separate exhaust. Steam and oil conduits open into the oven.—R. S.

Heating Liquids, Impts. in Apparatus for. E. R. Waterman and R. R. Morison, both of San Francisco, U.S.A. Eng. Pat. 10,795, May 23, 1899.

The apparatus consists of a containing vessel for the liquid, provided with a central, annular, double-walled chamber, the inner space of which is in open communication with the main vessel and has a bottom coincident therewith. Openings are made through the bottom of the vessel coincident with the space between the walls of the annular chamber, and an electric heater is adapted to be introduced into this space.—R. A.

Kilns or Furnaces, Burning and Drying, Impts. in. H. F. J. Weijers, Tilburg, Netherlands. Eng. Pat. 12,999, June 22, 1899.

The kiln or furnace has a drying chamber, with a burning chamber on each side, and with chambers, both above and below its entire length, for carrying off the heated and smoke gases from the burning chamber. The upper one is the collecting chamber for the heated gases, and is separated from the drying passage by a roof. The lower chamber has a series of pipes running its entire length, which serve for carrying off the smoke from the combustion chamber, and are surrounded by the hot air drawn off from the burnt-out or finished chambers. This heated air is caused to circulate vigorously through the material to be dried, then around the pipes, and again through the material, and so on.—R. S.

Regenerators for Gas Retorts, Smelting Furnaces, Coke Ovens, and Kilns; Impts. in. J. West, Manchester. Eng. Pat. 8779, April 26, 1899.

The vertical walls of the regenerator, forming passages for the waste gas and secondary air supply respectively, are provided with the usual horizontal divisions, to cause the gases to take a circuitous course, such divisions being, according to this invention, supported on ledges or recesses in the vertical walls so as to be quite independent of the latter.—R. S.

Gas Ignition Apparatus, Impts. in. A. Martini, Berlin. Eng. Pat. 27,198, Dec. 23, 1898.

The burner is surmounted by a suspended and partly counterbalanced plate containing an aperture over which is suspended a pillule of self-igniting material, and the shock of the explosion when the gas is ignited forces the plate into a vertical position, and thus causes the pillule to assume a position out of contact with the flame.—C. S.

Inflammable Fluids, Improved Apparatus for Burning. J. S. Goodwin, London. Eng. Pat. 394, Jan. 7, 1899.

The inventor claims "means whereby gases or vapours are freely generated from an exposed wick surface by a small flame formed at the top of the said wick, such wick being fed for the purpose of supporting the flame and of generating the gases and vapours with oil or other suitable combustible liquid contained in a receptacle arranged in the lower part of the apparatus;" also means for conveying the gases or vapours through a central tube to a burner at the top; and means for mixing the gas with air.—C. S.

Burners, Atmospheric, for Heating Gas Stoves, Impts. in. J. W. B. Wright and H. Darwin, Birmingham. Eng. Pat. 18,411, Aug. 27, 1898.

To prevent the flashing back of the flame, the inventors arrange two cones above the mixing chamber, the inner cone allowing the mixed gas and air to escape outwards near the bottom into the outer cone which forms the nozzle of the burner.—C. S.

Burners, Bunsen; An Impt. in. O. Imray, London. From J. Moeller, Vienna. Eng. Pat. 19,778, Sept. 17, 1898.

For the more effectual admixture of the gas and air, the inventor provides the mouth of the jet with a number of diametrically opposed notches or depressions, whereby the emerging gas is caused to spread out laterally.—C. S.

Burners, provided or not with Chimneys, Impts. in Means for Lighting Incandescing and other Gas. B. J. M. Mills, London. From P. Bardot, Lyons, France. Eng. Pat. 20,524, Sept. 18, 1898.

The claim is for "the combination of a three-way cock, a perforated ascending pilot gas lighter tube, the Bunsen burner and a movable pane [of glass] in the bottom of the lamp or lantern, which is closed by the movement of the cock on the complete opening of the burner," together with an operating lever on one side of the plug of the three-way cock, a pane-operating lever on the opposite side of the plug, and a link connecting this lever with the pane.—C. S.

Burner, Self-Lighting Gas. R. Beese, Dresden, Germany. Eng. Pat. 11,157, May 29, 1899.

The arrangement of the burner is such that when the gas is turned on, a small supply is delivered to a subsidiary burner, below the burner proper, where it is ignited automatically by a self-igniting mass. The flame heats an adjacent compound metal plate which by its expansion opens a valve and admits gas to the main burner, which is thereupon ignited. The same expanding movement of the metal plate also actuates the cut-off valve supplying the subsidiary burner.—C. S.

Burners, Gas or Vapour, Impts. in. W. G. Potter, Birmingham. Eng. Pat. 11,491, June 2, 1899.

The arrangement of the burner is such that the gas, which enters through a regulating float valve, ascends and descends through a closed double central heating tube, and again ascends between two rings forming the burner. A perforated spreader is fixed outside and about half way up the central tube.—C. S.

Gas for Illuminating and other Purposes, An Improved Process for the Production of. H. H. Böhndel, Hamburg, and C. C. Yeaton, London. Eng. Pat. 16,670, July 30, 1898.

Claim :—"The process for the production of combustible gas consisting in passing a blast of air through a sealed vessel containing calcined kieselguhr or infusorial silica, impregnated with a suitable hydrocarbon."—H. B.

Gas Apparatus, Illuminating, Impts. in. J. M. Hadden, New York. Eng. Pat. 13,888, July 5, 1899.

This invention relates to a device applicable "more particularly to the superheater of the Lowe or other standard type of gas apparatus." When the valve at the top of the superheater, as ordinarily arranged, is opened, a large volume of heated gas is lost by passing into the atmosphere. According to this specification an elbow-pipe, provided with suitable dampers and communicating with a horizontal flue, is mounted above the valve at the top of the superheater; when the valve is opened, the hot gases pass into the horizontal flue and thence to a fuel economiser, where the waste heat is utilised for steam raising. The six claims are for the combinations of parts.—H. B.

Incandescence Burners, Impts. in the Manufacture of Glow-Bodies for. G. Kohl, Vienna. Eng. Pat. 15,958, July 21, 1898.

For the purpose of strengthening the heads of incandescence mantles, the tops of the previously impregnated and dried fabrics are treated with a solution composed of water, 1·5 kilos.; aluminium nitrate, 300 grms.; magnesium nitrate, 300 grms.; chromium nitrate, 2 grms.; manganese nitrate, 2 grms.; calcium nitrate, 20 grms.; alum, 5 grms.; and borax, 5 grms.—H. B.

Incandescent Gas Light, A Process for the Production of. A. J. Boult, London. From E. Salzenberg, Krefeld, Germany. Eng. Pat. 12,429, June 14, 1899.

There is claimed a process for the production of incandescent gas light consisting in the introduction of gas under a pressure of one atmosphere or more above ordinary atmospheric pressure into a close-meshed mantle capable of being inflated to a balloon shape and secured to the burner by means of threads of asbestos, &c.—H. B.

Gas, specially intended for Incandescent Lighting and for Heating Purposes, Improved Means and Apparatus for the Production of. L. J. F. Nicolai, Dresden, and A. McNab, Menstrie, Scotland. Eng. Pat. 13,723, July 3, 1899.

There is claimed the process of producing gas for lighting, &c., by blowing air through infusorial earth saturated with liquid, volatile hydrocarbons. There is also claimed an apparatus for doing this, consisting of a lower closed tank fitted with perforated shelves, between which the infusorial earth is loosely laid, and having a perforated spreader for distributing the volatile hydrocarbon. Above the tank is mounted the oil-reservoir, which is connected with the spreader. Pipes for admitting the air from a blower and for leading off the saturated air are fixed within the lower tank.—H. B.

Gas [Acetylene], Washing and Purifying, Improved Apparatus for. E. Evans, Llanrwst, N. Wales. Eng. Pat. 11,676, May 23, 1898.

The apparatus consists of a closed tank, preferably rectangular, containing water or other suitable liquid. The tank is surmounted by a cylindrical vessel, which passes down through the top of the tank a short distance, so as to be slightly immersed in the water; the cylinder is closed at the top by means of a removable plate, but it is open at the bottom. A bucket-like vessel rests within the cylinder, and is fitted with a double false bottom of wire gauze. The gas to be purified is led into the tank through a pipe which passes down through the top of the tank to a point below the level of the wire-gauze bottoms of the cylindrical vessel. The action of the apparatus may be understood from the first of the seven claims, *viz.*, "An apparatus for washing and purifying gas, comprising a tank to hold the cleansing fluid, and having means for admitting the crude gas to below the level of the fluid therein, a layer or layers of gauze or the like wholly or partly immersed in the cleansing fluid, but above the point at which the gas enters said fluid, and an exit for the purified gas above the gauze, the parts being so arranged that the crude gas admitted into the fluid can only escape to said exit by passing upwards through said gauze while immersed in the fluid and thus be purified before reaching the exit."—H. B.

Acetylene Gas Machines for House Lighting and the like, Impts. in. B. Haigh, London. Eng. Pat. 10,023, May 2, 1898.

A projection on the bell of a gasholder, into which the generated gas passes for distribution, actuates a tumbler-lever which controls a check valve, by which water passes on to carbide, or granulated carbide passes into water, in a suitable generating vessel. A weighted valve on the inlet to the gasholder prevents the return of gas to the generator. —J. A. B.

Acetylene Generating Apparatus, Impts. in. J. St. C. Legge, Dublin. Eng. Pat. 16,487, July 29, 1898.

Water passes from the tank of a gasholder to the annular space between a carbide container and a bell-shaped casing, and rises therein until it reaches and passes through perforations to the carbide in the container. The gas is evolved, and passes through a cooler and purifier to the gasholder, until the bell of the latter has risen to a given height, and a rod attached to it closes a bifurcated lever tap on the gas pipe. The pressure of the gas in the generator then forces back the water from the carbide container, until the bell of the gasholder descends, and through the attached rod reopens the tap.—J. A. B.

Acetylene Gas Generators, Impts. in. J. Kremer, Gilly, Belgium. Eng. Pat. 18,133, Aug. 23, 1898.

The improvements relate to the generator described in Eng. Pat. 26,776 of 1897 (this Journal, 1898, 1132). The vertical rod, which serves to close the distributing hopper, is provided with an extension of reduced thickness, and is also protected by a cylindro-conical sheath, in order to avoid jamming. Means of discharging the residual mud without the whole of the water in the generator needing to be replaced, are also described.—J. A. B.

Acetylene Producers, Impts. in. G. Matthyssens, Antwerp. Eng. Pat. 18,436, Aug. 27, 1898.

A GENERATING vessel is divided into a number of compartments, each of which contains a carbide receptacle and a superposed water-jacketed bell. Water reaches the carbide through perforations at a suitable level in each bell. It is supplied to the generating vessel from a water reservoir, and the supply is controlled by the movements of the receiving and distributing gasholder, which raises and lowers, through a counter-weighted cord, the mouth of a flexible discharge pipe. A safety escape cock to the gasholder, a washer, a purifier, and other accessories are provided.—J. A. B.

Acetylene Gas, Impts. in Apparatus suitable for Generating and Supplying. W. L. Wise, London. From F. C. Wilson, Chicago, U.S.A. Eng. Pat. 18,741, Sept. 1, 1898.

THE lower half of a tank comprises a water chamber, in which is a generating chamber containing a slightly-inclined tray of carbide, to which water is admitted through a valve from the water chamber. The gas evolved, passes into a gasholder, the bell of which floats in the annular space between the wall of the upper half of the tank and an internal chamber which serves to mix the gas thoroughly as it passes away to the burners. The pressure thrown by the bell increases as it rises, owing to a number of weights being caught up in turn as the bell is raised by the gas. The pressure of the gas in the bell drives back the water from contact with the carbide, and thus restrains the generation of gas until the bell descends. An auxiliary generator is provided for filling the gasholder when it is necessary to put the main generator out of action.—J. A. B.

Acetylene Gas, A New or Improved Portable Generator of. G. Hansen and A. Kraefting, both of Copenhagen. Eng. Pat. 19,106, Sept. 7, 1898.

A CARBIDE chamber is attached to a subjacent water tank by a flexible connecting tube, and communicates therewith by a wick which is contained in telescoping tubes. The wick conveys water to the carbide, and the pressure of the evolved gas distends the flexible connection and depresses the water tank, thereby removing the wick from contact with the carbide, and thus arresting the generation of gas. —J. A. B.

Acetylene Gas from Carbides, An Improved Method of Regulating the Production of. H. H. Lake, London. From R. Türr, Paris. Eng. Pat. 20,996, Oct. 5, 1898.

CARBIDE is supported in a basket in a bell-shaped vessel to which water gains access from an encompassing tank. On the top of the water in the bell floats a layer of petroleum, toluol, or other liquid hydrocarbon of density 0·7 to 0·8, which comes in contact with the carbide and arrests the production of gas as soon as the water in the bell is depressed below the basket of carbide by the pressure of the gas produced.—J. A. B.

Acetylene Gas, Impts. in Apparatus for the Production of. J. McConechy, Glasgow. Eng. Pat. 21,038, Oct. 6, 1898.

THE generator consists of a trough divided by vertical partitions into a number of cells, each of which contains carbide. Water flows from one cell to the next as soon as the carbide in the first cell is exhausted. The partitions and walls may be hollow, and the water made to circulate through them in order to absorb the heat liberated by the reaction. The gas evolved, passes to a superposed storage gasholder.—J. A. B.

Acetylene Gas Apparatus, Impts. in. L. Troubetzkoy, Milan. Eng. Pat. 24,002, Nov. 14, 1898.

THE lower portion of a bell-shaped vessel, the upper part of which is partitioned off and serves as a water tank, fits within the annular space between an outer tank and an inner receptacle, in which is a vessel containing a number of superposed boxes. These boxes are open at the top, and decrease in size from the bottom upwards, and each contains carbide. Water flows from the tank into the boxes in turn, commencing with the uppermost, through a pipe with a tap which is actuated by the movements of the bell of the gasholder which receives the gas, so that the water-feed, and therefore the production of gas, are regulated according to the consumption.—J. A. B.

Acetylene Gas, Improved Process for the Production of. K. Gossweiler, Heilbronn, Germany. Eng. Pat. 27,252, Dec. 24, 1898.

PULVERISED carbide is dissolved or suspended in a suitable liquid, such as a mineral oil approximately of like specific gravity, which does not decompose it, and it is then brought in contact with water for the production of acetylene. The carbide in the liquid is said to occupy less space and to give a more uniform production of gas than solid carbide.—J. A. B.

Acetylene Gas Generators, Impts. in. F. Rhind, Bridgeport, U.S.A. Eng. Pat. 2226, Jan. 31, 1899. (Under Internat. Convention.)

WATER is conveyed from a font to a superposed carbide holder by a wick, and means, operated externally, are provided for cutting off the flow of liquid and at the same time covering the aperture through which the wick passes, in order that the production of gas may be quickly arrested if desired.—J. A. B.

Acetylene Gas Generators, Impts. in. R. H. and F. Sunderland and G. Marshall, all of Birmingham. Eng. Pat. 6274, March 23, 1899.

AN annular bell gasholder surrounds a shaft which contains a carbide holder, in which carbide is partially supported by sloping partitions, so that the whole weight of the charge does not come upon the conical base of the carbide holder. The base is provided with a valve actuated by a rod which passes to the top of the carbide holder. The valve is normally closed by the force of a spring exerted on the head of this rod, but when the bell of the gasholder descends, a cap, which is hermetically sealed to it and closes the top of the shaft, depresses the rod, and thereby opens the valve, and allows carbide to fall into the water in a subjacent generating tank. The gas evolved passes through a cooling coil in the gasholder tank to the gasholder.—J. A. B.

Acetylene Lamps, Impts. in. F. W. Hedgeland, Chicago, U.S.A. Eng. Pat. 6602, March 27, 1899.

A WATER reservoir surrounds a generating chamber which surmounts an equalising chamber, to which water passes through a pipe, with valve, from the reservoir. From the equalising chamber the water passes to the carbide in the generating chamber at a rate determined by the pressure of the gas therein, acting, through a narrow tube, on the surface of the water in the upward passage leading to the generating chamber.—J. A. B.

Acetylene Lamps, Impts. in and relating to. A. E. Thinault, Chinon, France, and M. Dreyfus, Paris. Eng. Pat. 7099, April 4, 1899.

WATER is conveyed to carbide in an internal vessel up the capillary space between a plain or threaded rod and its encompassing tube, which is perforated to permit the passage of the water, and may be thickened and jacketed to prevent the heat disengaged during the generation of gas, vaporising the water in its ascent to the carbide vessel.—J. A. B.

Acetylene Gas Generators, Impts. in or relating to. K. Küppers and H. Schroeder, both of Aix-la-Chapelle. Eng. Pat. 8339, April 20, 1899.

THE valve at the base of a funnel-shaped carbide hopper, which surmounts a generating chamber, the bottom of which communicates with an exterior vessel of water, is actuated through a lever by a float on the water in the generating chamber. When the pressure of the gas in this chamber increases, it depresses the water, and therewith the float, thus closing the valve through which carbide falls into the chamber. A device for indicating the height of the carbide in the hopper is also described.—J. A. B.

Acetylene Gas Generator, Improved. O. Boettcher, Charlottenburg, Germany. Eng. Pat. 8765, April 26, 1899.

A CARBIDE holder is suspended in a water tank by means of a threaded sleeve on the gas outlet pipe, which passes through the cover of the tank. A valve housing projects inwardly from the base of the carbide holder, and is provided with a tapering opening in its conical tip. The lower part of the housing has a valve seating on which a valve is normally pressed by a spring, but is raised to allow the passage of water through the tapering opening to the carbide when a stem projecting downwards, is brought in contact with the base of the tank by the carbide holder being lowered into the latter by the turning of a hand wheel on the threaded sleeve. A needle point, on further lowering of the carbide holder, is forced into the tapering opening, and serves to regulate the inflow of water or to remove obstructions from the opening. When the pressure of gas in the carbide holder exceeds that of the head of water in the tank, the inflow of water is automatically stopped.—J. A. B.

Acetylene Gas Generators, Impts. in. A. H. Deike, A. W. Alexander, and J. Mitchell, all of Guelph, Ontario. Eng. Pat. 9743, May 9, 1899.

A CARBIDE holder, consisting of a number of sections with hinged bottoms, is supported above water in a generating chamber. The bottoms of the sections are released in turn by the rotation of a shaft with projecting pins arranged spirally on its perimeter, so that they engage in turn with the pivoted supports of the bottoms of the sections. The shaft is rotated whenever the gasholder which receives the generated gas, descends.—J. A. B.

Acetylene Gas, Impts. in and relating to the Generation of. E. Fenderl, Vienna. Eng. Pat. 11,116, May 27, 1899.

CARBIDE is fed through a hopper into a water tank in which is a spiral which is rotated within a sieve and carries forward and agitates the carbide, so that any coating of lime which forms thereon, is removed, and the carbide is decomposed at a uniform rate. Several modifications of this device are described.—J. A. B.

Acetylene Generators, Impts. in and relating to. E. Hilberg, Berlin. Eng. Pat. 11,494, June 2, 1899.

CARBIDE passes from a receptacle into water in a subjacent tank, through a valve consisting of two india-rubber flaps, which are kept apart by a rod attached to a flexible diaphragm, which is forced outwards when the pressure of gas increases, thereby raising the rod and allowing the valve to close and interrupt the passage of carbide and the generation of gas. In the event of excessive pressure arising, water and, eventually, gas, escape through a pipe which rises from near the bottom of the tank.—J. A. B.

Acetylene Lamps, Impts. in. W. P. Thompson, London. From T. Morin and A. Straguin, both of Paris. Eng. Pat. 11,551, June 2, 1899.

WATER flows from a reservoir through a tube with a plug to a receptacle containing carbide, from which the gas generated, escapes through a filtering medium to the burner. The admission of air to the water reservoir is controlled by a ring of rubber, which more or less covers the inlet aperture, according to the rate at which the generation of gas is required to take place.—J. A. B.

Acetylene Generator. G. Nowak, Bistritz, and P. Klemm, Klausenburg, both in Austro-Hungary. Eng. Pat. 12,659, June 17, 1899.

A BELL floating in a tank of water supports a carbide receptacle, so that in the lowermost position of the bell, the water comes in contact with the carbide and causes the generation of gas, which passes to a gasholder through a pipe in which is a valve provided with a toothed sector, which gears with a rack on the bell of the gasholder, so that the latter closes the valve when the bell reaches a given height. Gas subsequently evolved, lifts the bell of the generator, and therewith the carbide receptacle, from the water. If the bell of the generator continue to rise owing to the action of the water retained by the carbide on the latter, a second exit pipe becomes unsealed and conveys the surplus gas thus formed to the gasholder.—J. A. B.

Acetylene Gas Apparatus, Impts. in. J. N. Goldbacher, New York, and E. Bournonville, Jersey City, U.S.A. Eng. Pat. 13,301, June 27, 1899.

CARBIDE is discharged from a hopper into a shoot leading to a generating tank containing water, through the medium of a wheel, which is moved so as to effect the discharge of a certain quantity of carbide, whenever the bell of the receiving gasholder descends to a certain point. The gas passes to this gasholder through a trap and a filtering chamber. The gasholder tank occupies the upper part of one side of the generating apparatus, for which compactness—having regard to its producing power—is claimed as a special feature.—J. A. B.

Calcic Carbide and Illuminating and Heating Gases, Impts. in and connected with the Manufacture of. H. Eldridge, D. J. Clark, S. Blum, and A. A. Blum, all of Galveston, U.S.A. Eng. Pat. 9156, May 1, 1899.

Two series of coils or pipes are arranged in an electric furnace in which carbide is produced, so that they are heated by the surplus heat from the arc. One series is used to heat a stream of air, which is driven through volatile hydrocarbon and carburetted thereby, and the other series is used to superheat the carburetted air. The carbide produced in the furnace is used in a generator for the production of acetylene, which is mixed with the carburetted air in such proportions as will give a gas of the desired illuminating or heating value. An insulated hood for collecting the fumes from the furnace is described.—J. A. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

Acetic Ether, Utilising the Vapours produced in Charcoal Making for the Manufacture of. Th. Chandelon. Bull. Assoc. Belge des Chim. **13**, [5], 231—236.

THE vapours given off during the conversion of wood into charcoal for the maker of gunpowder, and which are at present wasted, except where used as fuel, can, according to the author's investigations, be utilised as raw material for the manufacture of acetic ether, a body almost indispensable in the preparation of smokeless powder. With this object he proposes to pass the vapours through condensers similar to those employed by wood distillers, or else through coke towers containing pyroligneous acid from a previous operation, the permanent gases being returned to the furnace. The pyroligneous acid he neutralises with a thick milk of lime, an excess of 10 per cent. being allowed for impurities, and he then concentrates the mixture, without filtering, on the water-bath to one-third the original volume of the crude acid. This mass is introduced, whilst hot, into a still, where it is mixed with ethylsulphuric acid (prepared from 88—90 per cent. alcohol and sulphuric acid of 60° B.), the quantity corresponding to 1 mol. of alcohol per 1 mol. of acetic acid and 2 mols. of sulphuric acid per 1 mol. of lime. The still is connected with a vertical bulb-condenser leading to an inclined condenser which discharges into a receiver of the Florentine bottle type, by way of a tube containing crystals of common salt, whilst the receiver is partly filled with a solution of common salt, in which acetic ether is insoluble.

When the spontaneous reaction of the contents of the still has subsided, heat is applied by means of a water-bath, and ebullition continued for an hour, whereupon the supply of cooling water to the reflux condenser is discontinued and distillation begins. The ether is dehydrated by the sodium chloride crystals, and collects in the upper part of the receiver. Finally a current of steam is passed through the still, and the condensed water, which becomes saturated with salt, passes into the receiver, from which it is automatically discharged through the lower orifice, the ethereal layer running off through a lip at the top.

The brine frees the acetic ether from the greater part of the alcohol and acid impurities, the remainder being afterwards removed by agitation with milk of lime; and the product is rectified in a Le Bel-Henninger apparatus, the fraction passing over at 74°—76° C. being recovered. The average yield obtained from 2 litres of crude (14·37 per cent.) pyroligneous acid—with a consumption of 285 grms. of 88 per cent. alcohol, 689 grms. of 57·1 B. sulphuric acid, and 141 grms. of CaO—was 333 grms. of acetic ether (sp. gr. 0·8903 at 20° C.). The concentration of the crude acid has an appreciable influence on the yield, the best results being obtainable by the procedure named above; filtration has no influence and is therefore unnecessary. The substitution of sulphuric acid and alcohol, added separately, for ethylsulphuric acid, results in a wastefully violent reaction.

The author believes that the process could be pursued on a manufacturing scale without difficulty.—C. S.

Still-Heads for Fractional Distillation, Relative Efficiency and Usefulness of Various Forms of; with a Description of some New Forms possessing Special Advantages. S. Young. Trans. Chem. Soc. 1899, 679.

See under XXIII., *page* 859.

Tar Concentration [*in Gas Plant*], *Prevention of.* G. Liegel. J. für Gasbeleucht. 1899, **42**, [32], 521.

See under II., *page* 817.

Wood Naphthas, The Examination of. Government Laboratory Method, 1899.

See under XXIII., *page* 867.

Wood Preservatives, The Use of Petroleum Products as. A. Charitschkow. Zeits. für angew. Chem. 1899, [32], 757.

See under IX., *page* 833.

Petroleum Products [*Phenols, &c.*], *Disinfectant Properties of, and their Employment for the Impregnation of Wood.* K. W. Charitschkow. Zeits. angew. Chem. 1899, [31], 737.

See under XVIII. C., *page* 852.

PATENTS.

Acetone, Impts. in the Manufacture of. J. L. Hawliczek, Liverpool. Eng. Pat. 15,907, July 21, 1898.

The patentee mixes wood-sawdust, peat, turf, or any like substance which on dry distillation yields acetic acid, with the oxide, hydrated oxide, or carbonate of an alkaline earth, and distils the mixture in an apparatus consisting of inclined retorts, of which a drawing is given. It is said that the acetic acid formed, is converted almost entirely into acetone and passes over together with other volatile products such as wood-tar, and methyl alcohol. The former is separated by decantation and the acetone and methyl alcohol are separated by rectification.—T. A. L.

Paraffin, Solid, from Liquid Hydrocarbons, Improved Method and Means for Congealing and Separating. J. Wishart, Glasgow. Eng. Pat. 19,439, Sept. 13, 1898.

In order to recover solid paraffin from liquid paraffin or other hydrocarbon in the liquid state, the patentee passes the liquid through a coil contained in a refrigerating vessel and then through a filter press, by which means the solid paraffin is separated. A drawing is given in vertical section of the refrigerator, consisting of a coil of pipe in a closed vessel containing cold brine.—T. A. L.

IV.—COLOURING MATTERS AND DYESTUFFS.

Yellow Colouring Matters accompanying Chlorophyll, and their Spectroscopic Relations. C. A. Schunck. Proc. Roy. Soc. 1899, **65**, 177—186.

The author finds two yellow colouring matters accompanying the chlorophyll in all crude alcoholic extracts of healthy green leaves. One of these, chrysophyll, separates out as lustrous red crystals on standing; the other, obtained by treating the extracts with animal charcoal in the cold and allowing to evaporate spontaneously, is an amorphous substance impregnated with much fatty matter. To this, which is the predominating yellow colouring matter accompanying chlorophyll, the name "xanthophyll" is restricted. It is identical with the principal yellow colouring matter of faded autumnal leaves.

The absorption spectra of these substances were also investigated. Crude chlorophyll solutions, in addition to the characteristic spectrum of four bands in the less refrangible portion, give three characteristic bands in the violet due to chlorophyll itself and not to any of the accompanying yellow colouring matters, as has been hitherto supposed.—J. S.

Fluoran [*Phenolphthaleïn Anhydride*]. R. Meyer and L. Friedland. Ber. **32**, [12], 2108—2112. (See this Journal, 1893, 439—440.)

The authors have already prepared 2.7-dinitro-, a trinitro-, and a pentanitrofluoran, and have converted the first-mentioned through the amido compound into hydroquinone phthaleïn. They now find that it is possible to obtain a mononitro- and a second dinitrofluoran, and they have further converted the 2.7-dinitro derivative into 2.7-dinitrohydrofluoranic acid. *Mononitrofluoran* is obtained by dissolving fluoran in 10 times its weight of glacial acetic acid, and, after cooling, adding an equal volume of nitric acid (sp. gr. 1·5), the whole being boiled for one hour under an inverted condenser. The crystals which separate on cooling, melt at 202° C. On reduction with stannous chloride, *amidofluoran*, $C_{20}H_{11}O_3NH_2$, is obtained, which crystallises from alcohol in colourless plates melting at 228° C. and dissolving in cold concentrated sulphuric acid with a yellow colour and faint greenish fluorescence. On warming, the solution turns dark red, becomes green on dilution with water, and reddish-violet when neutralised with soda lye. When diazotised and boiled with water it forms fluoran.

i-Dinitrofluoran is obtained by heating 10 grms. of fluoran and 100 c.c. of nitric acid (sp. gr. 1·5) on the water bath for eight minutes. After standing for 2—3 hours, the 2.7-dinitrofluoran is filtered off and the filtrate is poured into water. The light yellow flocculent precipitate, after crystallisation from glacial acetic acid, forms thick needles melting at 220° C. When reduced with stannous chloride, it forms *i*-diamidofluoran, which separates from alcohol in small rhombic crystals melting at 240° C. With concentrated sulphuric acid it behaves like monoamido and 2.7-diamidofluoran, and on boiling its diazo compound with water it yields fluoran. On attempting to partially reduce 2.7-dinitrofluoran with ammonium sulphide, the nitro groups remained unattacked, but the lactone ring was split and there resulted 2.7-dinitrohydrofluoranic acid—

$$HO_2C.C_6H_4.CH:(C_6H_3[NO_2]_2)_2:O.$$

This product crystallises from glacial acetic acid in large flat needles melting at 247° C. It differs from dinitrofluoran in being more soluble in alcohol, and moreover possesses acid properties. The solution in alcoholic potash is colourless, becoming cherry-red on boiling. Cold concentrated sulphuric acid gives a yellow solution, the colour becoming darker on warming, when water produces no precipitate. If, however, the solution be very carefully warmed, a precipitate is obtained on adding water, but in neither case was a phthalidine reaction detected on extraction with ether.

—T. A. L.

m-Amidophenol and Rhodamine. R. Meyer and W. Lundmacher. Ber. **32**, [12], 2112—2124.

Of the various methods for obtaining *m*-amidophenol, that of fusing metanilic acid with caustic soda (Ger. Pat. 44,792) gave the best results, but it must be noted that the purity of the metanilic acid is of importance. A copper vessel heated by means of an oil bath is charged with 300 grms. of caustic soda and 60 c.c. of water, and heated to 270° C., 150 grms. of well dried metanilic acid being then gradually added. The melt is kept for 1 hour at 280°—290° C., dissolved in water, neutralised with hydrochloric acid and filtered from tarry matter. After neutralising with sodium carbonate, the solution is extracted with ether, which deposits the *m*-amidophenol as a brownish mass. It can be purified by recrystallisation from water or toluene, and a yield of 70 per cent. was obtained. The substance forms stable crystals, melting at 122° C., and the following derivatives have been obtained from it: *m-Hydroxyphenylurea*, $H_2N.CO.NHC_6H_4.OH$, prepared by mixing aqueous solutions of *m*-amidophenol hydrochloride and potassium cyanate. It forms colourless prisms, melting at 181° C. On heating this substance with aniline it yields *m*-hydroxycarbanilide, melting at 232° C., or, if *m*-amidophenol be employed in place of aniline, there results *m*-dihydroxycarbanilide, melting at 222° C. Of the corresponding sulphur derivatives, *m*-hydroxyphenylthiourea melts at 184° C., *m*-hydroxythiocarbanilide at 156° C., and *m*-dihydroxythiocarbanilide at 165° C. On boiling *m*-amidophenol with ethylic oxalate, the ethyl ester of *m*-hydroxyphenyloxamic acid is formed. It crystallises in colourless needles melting at 184° C. The product is readily hydrolysed, forming *m*-hydroxyphenyloxamic acid, melting at 215° C. The ester, on treating with ammonia, forms *m*-hydroxyphenyloxamide, silky needles melting at 227° C., whilst *m*-dihydroxyphenyloxamide is obtained by heating ethylic oxalate and *m*-amidophenol in a sealed tube to 170° C. for half an hour. The product forms needles melting at 270° C. Phthalic anhydride condenses with *m*-amidophenol in the same way that resorcinol does, yielding rhodamines; but whilst simple fusion is sufficient in the case of the alkylated *m*-amidophenols, it is necessary with *m*-amidophenol itself to employ a condensing agent like concentrated sulphuric acid, in order to protect the amido group. When solutions in toluene of phthalic anhydride and *m*-amidolphenol are mixed, a yellowish crystalline precipitate is obtained, which consists of *m*-hydroxyphthalanilic acid—

$$HO_2C.C_6H_4.CO.NH.C_6H_4.OH,$$

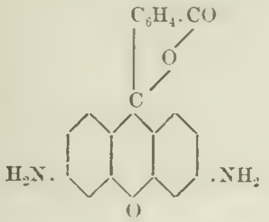
melting at 229° C. Similar condensation products, in which the amido group reacts, are obtained from phthalic anhydride and aniline, forming phthalanilic acid—

$$HO_2C.C_6H_4.CO.NHC_6H_5,$$

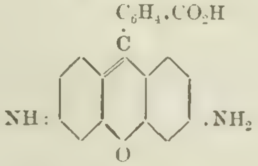
and from benzoic anhydride and aniline, forming benzanilide, melting at 161° C., whilst benzoic anhydride and *m*-amidophenol yield *m*-hydroxybenzanilide—

$$C_6H_5.CO.NH.C_6H_4.OH,$$

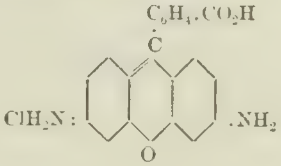
which crystallises from toluene in thin matted needles melting at 174° C. As already mentioned, when *m*-amidophenol (14 grms.) is dissolved in concentrated sulphuric acid (100 grms.), mixed with phthalic anhydride (20 grms.), and heated for four hours to 180°—190° C., condensation to rhodamine takes place. The dark reddish-brown melt is poured into 500 c.c. of water, when the sparingly soluble sulphate precipitates. The base is obtained by decomposing this salt with sodium acetate and recrystallisation from water, although only a poor yield of pure base was obtained. The base shrivels at 230° C. and melts at 252° C. It forms a sparingly soluble sulphate and hydrochloride. On heating with acetic anhydride, acetyl-rhodamine is obtained in the form of slightly yellowish plates, melting at 173° C. Since fluoresceïn chloride can be converted into alkylated rhodamines, it follows that rhodamine itself is a fluoran derivative, and that the nitrogens have the positions 3·6. Hence it ought to be possible to convert rhodamine into fluoresceïn, and by adding sodium nitrite to a boiling solution of rhodamine sulphate, and purifying the product obtained, it was found to be fluoresceïn. Rhodamine base has therefore one of the two following formulæ:—



or—



whilst its salts have the constitution—



Rhodamine is thus isomeric with 2.7-diamidofluoran and with *i*-diamidofluoran (see preceding abstract), neither of which possesses any dyestuff characteristics.—T. A. L.

Phthalic Acid, Aniline Salts of. C. Graebe and J. Buenzod. Ber. **32**, [12], 1991—1995.

It has already been shown (Ber. **29**, 2802) that phthalic acid only combines with one molecular proportion of aniline and that the compound on heating to 90—100° C. is decomposed quantitatively into aniline and phthalic acid, whilst if heated more quickly, the chief product is phthalanil. On further investigating this reaction, the authors have examined certain hydroxy-, chloro-, bromo-, and nitro-derivatives of phthalic acid in the same way, and, as might have been expected, these compounds are more strongly acid than phthalic acid itself. Although they only form mono-substitution products with aniline, the salts obtained are much more stable, only small quantities of the free acids are produced on heating, and the corresponding phthalanil compounds are formed. This method can be employed for separating phthalic acid from its mono-substituted derivatives.—T. A. L.

Diphenylmethane, Some Derivatives of. R. Meyer and A. Conzetti. Ber. **32**, [12], 2103—2108.

In the course of an investigation to determine what relation existed between fluorescence and constitution (this Journal, 1898, 418), one of the reactions made use of was the soda fusion of fluoresceïn chloride (Ber. **30**, 969). It was found that a small quantity of a phenolic substance was formed, which proved to be di-*o*-di-*p*-tetrahydroxybenzophenone, a product soluble to a yellow non-fluorescent solution in alkali. On simply heating this substance above its melting point, it is converted into 3.6-dihydroxyxanthone, which dissolves in alkalis with a violet fluorescence. The yield is, however, unsatisfactory, and better results are obtained by heating the phenol with twice its weight of water for 3—4 hours to 190°—200° C. It does not dye animal or mordanted vegetable fibres. On boiling with sodium acetate and acetic anhydride, 3.6-dihydroxyxanthone yields a diacetate. When treated with bromine in glacial acetic acid solution, it is converted into tetrabromodihydroxyxanthone. With a view of obtaining an improved yield of 3.6-dihydroxyxanthone, the authors attempted to condense 2.4-dibromoresorcinol with *β*-resorcylic acid or its bromine

derivative, to obtain a xanthone, but without success. They show, however, that the same dibromoresorcinol is obtained from eosine and from dibromo-β-resorcylic acid and has the constitution $Br_2:(OH)_2$ · 2:4:1:3. By the action of formaldehyde on naphthoresorcinol, tetrahydroxydinaphthylmethane is formed. This product, on oxidation, gives formaldehydehydroxynaphthofluorone, but does not yield a dihydroxynaphthoxanthone. It was, however, possible to obtain a tetra-acetate of tetrahydroxydinaphthylmethane.
—T. A. L.

Aniline, Volumetric Method of Estimating. M. François and G. Denigès. J. Pharm. Chim. 1899, **9**, [11], 521, and **10**, [2], 63.

See under XXIII., *page* 866.

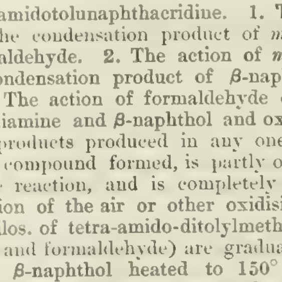
Metaphenylenediamine- and Paraphenylenediamine Hydrochlorides, Colour Reaction for. L. Cuniasse. Ann. Chim. anal. appl. **4**, 156; Chem. Centr. 1899, **1**, [26], 1297.

See under XXIII., *page* 865.

PATENTS.

Colouring Matters [Yellow] of the Acridine Series, Manufacture of New. C. D. Abel, London. From The Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany. Eng. Pat. 16,474, July 28, 1898.

The derivatives of acridine prepared according to this specification, are obtained by one of the following methods, the first product of the reaction in each case being the leuco derivative of amidotolunaphthacridine. 1. The action of β-naphthol on the condensation product of *m*-tolylenediamine and formaldehyde. 2. The action of *m*-tolylenediamine on the condensation product of β-naphthol and formaldehyde. 3. The action of formaldehyde on a mixture of *m*-tolylenediamine and β-naphthol and oxidation of the condensation products produced in any one of these cases. The leuco compound formed, is partly oxidised to the dyestuff in the reaction, and is completely converted by the further action of the air or other oxidising agent. For example, 25 kilos. of tetra-amido-ditolylmethane (from *m*-tolylenediamine and formaldehyde) are gradually stirred into 20 kilos. of β-naphthol heated to 150° C. The reddish-yellow melt gives off water, and when this has ceased, the temperature is raised to 200° C. After cooling, the melt is treated with soda-lye to remove unaltered naphthol, and the residue is dissolved in hot dilute hydrochloric acid, air being passed through the solution until a dark colour is obtained. The hydrochloride of the dyestuff is then precipitated by adding salt. The product has the following constitution—



and dyes tannin-mordanted cotton orange-yellow shades. The base separates from alcohol in lemon crystals melting at 240° C.; is almost insoluble in water, and sparingly soluble in ether, but readily in alcohol, acetic, and dilute mineral acids. The solutions in acids are orange-red and show a strong yellowish-green fluorescence. The acetyl derivative is slightly yellow. The colour base dissolves in sulphuric acid with an orange-yellow colour and a strong greenish fluorescence. On dilution with water the orange-yellow colour remains unchanged. The same dyestuff may be obtained by adding 1 kilo. of trioxymethylene to a mixture of 12 kilos. of *m*-tolylenediamine and 15 kilos. of β-naphthol heated to 150° C., the product being isolated in the manner already given. If an equivalent quantity of benzaldehyde be substituted for the trioxymethylene, the corresponding phenylated derivative of amidotolunaphthacridine is obtained, which dyes similar shades.
—T. A. L.

Acridine Derivatives, Manufacture of. C. D. Abel, London. From The Actien Gesellschaft fur Anilin Fabrikation, Berlin, Germany. Eng. Pat. 16,475, July 28, 1898.

The process described in the preceding specification is in the present one applied to the products obtained by replacing the *m*-tolylenediamine by *p*-toluidine, the resulting compound being tolunaphthacridine. For example, 3 kilos. of trioxymethylene are added to a fused mixture of 16 kilos. of β-naphthol and 11 kilos. of *p*-toluidine at 150° C. The temperature is then raised to 200° C., and the excess of toluidine, β-naphthol, and formaldehyde is removed by distillation at 300° C. The residue is purified by dissolving it in nitric acid, and on cooling, the nitrate of tolunaphthacridine separates out. The free base melts at 158° C. Similarly, a mixture of *p*-toluidine, benzaldehyde and β-naphthol yields phenyltolunaphthacridine melting at 213° C., whilst *p*-nitrobenzaldehyde, *p*-toluidine, and β-naphthol yields *p*-nitrophenyltolunaphthacridine.—T. A. L.

Naphthalenesulphonic Acids, Manufacture of Chlorinated. C. Rudolph, Offenbach a/M., Germany. Eng. Pat. 19,088, Sept. 7, 1898.

The patentee chlorinates salts of naphthalene mono- and poly-sulphonic acids by the action of gaseous or of nascent chlorine in aqueous solution. For example, 24 kilos. of manganese dioxide and 200 litres of hydrochloric acid (sp. gr. 1·19) are added to a solution of 85 kilos. of the calcium salt of 3·3′-naphthalene disulphonic acid, the whole being allowed to stand until a yellowish-white magma is obtained. After diluting with water and making faintly alkaline with milk of lime, the mixture is filtered hot, and the filtrate evaporated until it crystallises, when the calcium salt of 1·3·3′-chloronaphthalene disulphonic acid separates out.—T. A. L.

Monohalogen Derivatives of Aromatic Nitramines and Colouring Matters [Red to Bluish-Violet] derived therefrom; The Manufacture of. S. Pitt, Sutton. From L. Cassella and Co., Frankfort-on-Main, Germany. Eng. Pat. 19,327, Sept. 10, 1898.

Orthochloro-*p*-nitraniline is obtained, according to this specification, by passing chlorine into a solution of *p*-nitraniline in hydrochloric acid, or by adding sodium hypochlorite solution. The product so formed, when used for the production of azo-compounds, gives derivatives which are much bluer than the unchlorinated products, and are also faster to acid and light. Valuable dyestuffs are also obtained if the nitro-azo derivatives are carefully reduced to the corresponding amido derivatives. The following examples illustrate the various processes. A solution of 34·5 kilos. of *p*-nitraniline in 200 kilos. of concentrated hydrochloric acid is mixed with 400 kilos. of ice, cooled to − 10° C., and treated with a slow current of gaseous chlorine until an increase in weight of 18 kilos. has taken place. The chloro-*p*-nitraniline separates partially during this operation, and is completely precipitated by adding water. After one crystallisation from 25 per cent. acetic acid it is quite pure, and melts at 105° C. The chlorine gas in the above example may be replaced by a solution of 18·8 kilos. of sodium hypochlorite. For the preparation of a dyestuff, 50 kilos. of *o*-chloro-*p*-nitraniline are dissolved in 600 kilos. of acetic acid (50 per cent.), 350 kilos. of hydrochloric acid are added, and a concentrated solution of 20·7 kilos. of sodium nitrite is run in at about 30° C. The diazo solution is then cooled to 5° C., and mixed with a solution of 23 kilos. of β-naphthylamine sulphonic acid F, and an excess of sodium acetate. After making alkaline with sodium carbonate, and heating to 50° C., the dyestuff is filtered off. It dyes wool bright bluish-red shades. For the purpose of obtaining a reduced dyestuff, the solution of chloronitrodiazobenzene, obtained as above, is run into a solution of 26·2 kilos. of sodium *p*-amidonaphthol sulphonate and an excess of sodium acetate. The whole is made alkaline by adding 360 kilos. of caustic soda, and reduced with a solution of 125 kilos. of crystallised sodium sulphide, with constant agitation, at about 35° C. The reaction is complete in about 12 hours, when the bluish-violet solution has turned red. The dyestuff is then salted out. The specification contains a table showing the various shades obtained on wool from various dyestuff components directly and after reduction.—T. A. L.

Dyestuffs, Blue, of the Anthraquinone Series; The Manufacture or Production of. H. E. Newton. From The Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 19,009, Sept. 6, 1898.

The blue liquid obtained by heating 1.4′-dinitro-anthraquinone with fuming sulphuric acid (about 40 per cent. SO_3) was supposed to contain hexahydroxyanthraquinone disulphonic acid or its sulphuric ester, since the former is produced on pouring the melt into a large quantity of water. It is now found that the melt contains an intermediate compound, most probably a diquinone di-imide of the diamidoanthrachrysone disulphonic acid or its sulphuric ester, and the product may be separated by pouring the melt into a very cold aqueous solution of potassium or sodium chloride. In order to isolate this substance, 10 kilos. of 1.4′-dinitro-anthraquinone, 200 kilos. of fuming sulphuric acid (30 per cent. SO_3), and 2 kilos. of sulphur are heated for $1\frac{1}{2}$—2 hours to 120°—130° C. The melt is then cooled to 0° C. and poured slowly with constant agitation into a 20 per cent. potassium chloride solution cooled to −10° C., the precipitate being quickly filtered off, washed with cold brine, and dried at a low temperature. The product dissolves in concentrated sulphuric acid with a greenish-blue and in water with a violet-blue colour, which changes to greenish-blue on adding caustic soda-lye. An acid aqueous solution of the new product, when allowed to stand for some time, yields an anthradiquinone, ammonia being split off. This anthradiquinone dissolves in water with a violet-red and in concentrated sulphuric acid with a blue colour, whilst reducing agents convert it into hexahydroxyanthraquinone disulphonic acid. The patentees also find that the intermediate products above described, when treated with reducing agents, yield diamidotetrahydroxyanthraquinone disulphonic acids, and that the melt obtained as above may be worked up in the following manner:—After cooling to 20°—30° C., the melt is poured into 2,000 litres of ice-water and 20 kilos. of a 40 per cent. sodium bisulphite solution. The whole is then raised to 50° C. and the dyestuff is salted out, the product obtained consisting mainly of diamidoanthrachrysone disulphonic acid, which had been previously obtained by reducing dinitroanthrachrysone disulphonic acid with stannous chloride and hydrochloric acid (Eng. Pat. 13,395 of 1893; this Journal, 1894, 722).
—T. A. L.

Dyestuffs, Blue to Bluish-Green, of the Anthraquinone Series; The Manufacture or Production of. H. E. Newton, London. From The Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 19,698, Sept. 16, 1898.

This is an improvement of the process described in Eng. Pat. 23,927 of 1894 (this Journal, 1895, 1041), according to which blue dyestuffs were obtained by acting with primary aromatic mono- or diamido compounds on *p*-dinitroanthrarufin. The patentees now find that a new series of dyestuffs is produced if the *p*-dinitroanthrarufin be replaced by *p*-dinitroanthrarufin disulphonic acid or by *p*-dinitrochrysazin disulphonic acid. The products obtained are generally mixtures of three classes of dyestuffs termed A, B, and C, the characteristics of which are given below. A mixture of 5 kilos. of sodium *p*-dinitroanthrarufin disulphonate, 50 kilos. of aniline, 32 kilos. of glacial acetic acid, and 25 litres of water is heated on the water bath for 12 hours. After a short time crystals of A separate, and when the reaction is complete, the melt is cooled and these are filtered off, the filtrate, on pouring into a large quantity of dilute hydrochloric acid, giving a precipitate of B. The filtrate from this, when treated with potassium chloride, gives a small quantity of C. Dyestuff A separates in violet-blue crystals nearly insoluble in cold, more soluble in hot water, with an indigo-blue colour, which turns olive-green on adding caustic soda-dye. It dissolves in concentrated sulphuric acid with a yellow colour, which changes to red and then blue on standing, or more quickly on heating. It dyes unmordanted wool blue shades from an acid bath. The dyestuff B separates as a dark blue precipitate readily soluble in hot water, with a bluish-green colour, which turns green on adding alkalis. Concentrated sulphuric acid dissolves it with a yellow colour. It gives greenish-blue shades on unmordanted wool from an acid bath. The dyestuff C is readily soluble in water with a pure blue colour. It dissolves in concentrated sulphuric acid with a yellow colour, which turns green on adding boric acid. It dyes unmordanted wool bright greenish-blue shades from an acid bath. If in the above example the aniline be replaced by *p*-toluidine an analogous result is obtained, whilst if *o*-toluidine or *m*-xylidine be employed, C is the principal product of the reaction, and this is also the case if *p*-dinitrochrysazin disulphonic acid be employed.—T. A. L.

Indigo Leuco-products and Colouring Matters, and Intermediate Compounds relating thereto, The Manufacture of. B. Willcox, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 21,157, Oct. 7, 1898.

So-called "piperazine" or anhydro derivatives of alphyl glycocoll carboxylic acids are prepared, and then fused with caustic alkalis, when leuco compounds of indigo dyestuffs are obtained which can either be separated or oxidised to the indigo compounds. It is also found that new piperazine derivatives can be obtained by heating the esters of the alphyl glycocoll carboxylic acids, derived from amidomalonic acid, either with an indifferent solvent or alone at a temperature above 200° C., the by-products being separated by extraction with alcohol or acetone in which the piperazine derivative is but slightly soluble. For example, 1 kilo. of *p*-tolylglycocoll-carboxy-diethyl ester is dissolved in 1·5 kilos. of petroleum, and boiled at about 260° C. until the solution becomes a mass of crystals. These, after cooling, are filtered off, washed with petroleum ether, and extracted with glacial acetic acid from which the product separates. According to the alternative method, a mixture of 1 kilo. of β-naphthyl-glycocoll-carboxy-diethyl ester and 2 kilos. of α-chloronaphthalene is heated to about 260° C., until the melt becomes a mass of crystals. These are then washed with petroleum ether and extracted with glacial acetic acid. In order to convert these products into indigo derivatives, 1 kilo. of the tolyl-piperazine derivative and 4 kilos. of caustic potash are heated to about 250°—280° C., out of contact with the air, until the melt becomes deep orange-red and no further formation of colouring matter takes place. It is then cooled, powdered, and, if it be desired to separate the leuco compound, mixed with 6 kilos. of ice-cold dilute sulphuric acid (25 per cent. H_2SO_4), when the product separates out. To obtain the indigo compound, the melt is dissolved in water, and the dyestuff is precipitated by oxidising the leuco compound with a current of air.—T. A. L.

Gallocyanines, Manufacture of Leuco-derivatives of. J. Imray, London. From La Société L. Durand Huguenin et Cie., Hüningen, Alsace, Germany. Eng. Pat. 21,415, Oct. 11, 1898.

On further investigating the reaction described in Eng. Pat. 6055 of 1898 (this Journal, 1899, 573), the patentees find that the leuco-gallocyanines possess certain advantages over the original gallocyanines employed, giving, in dyeing and printing, bluer, purer, and stronger shades, and moreover their hydrochlorides are much more soluble in water. As an example of the method employed, 33 kilos. of Gallamine Blue (from nitrosodimethylaniline hydrochloride and gallamic acid) are suspended in 600 litres of warm water, 12 kilos. of hydrochloric acid are added, and then gradually with constant agitation, 20 kilos. of zinc-dust. Further 20 kilos. of hydrochloric acid are then added, and the whole is heated to 80°—90° C., and filtered, when the leuco derivative can be salted out. In order to purify it, it is again dissolved in warm water, made acid with hydrochloric acid, and after cooling, again salted out. The leuco-gallocyanines form greenish pastes which may be carefully dried. They dissolve in water with a brownish-green colour and in concentrated sulphuric acid with a dichroic brownish-violet colour which, on adding a small quantity of an oxidising agent, turns deep blue.—T. A. L.

Acetyl-Compounds of Substitution Derivatives of Aromatic Amines, Manufacture of. O. Imray, London. From The Farbwerke vormals Meister, Lucius und Bruning, Hoechst a/Main, Germany. Eng. Pat. 17,366, Aug. 11, 1898.

Hinsberg (Ber. **23**, 2962) has already shown that acetic anhydride reacts in the cold on aromatic amines in presence of water forming acetyl compounds. The patentees apply this reaction to the sulphonic and carboxylic acids of aromatic amines at about 50—60° C. For example, 7 kilos. of *o*-amidobenzoic acid are dissolved together with 3 kilos. of sodium carbonate in about 50 litres of water. Into this solution 6 kilos. of acetic anhydride are run, the whole being well agitated. After a few minutes the acetyl compound separates in crystals, and may be filter-pressed and dried. The method has the advantage over existing ones, that in the case of diamido-sulphonic or carboxylic acids, the amido groups may be successively acetylated, and also in the case of amidophenol sulphonic acids the amido group may be acetylated alone, or both it and the hydroxyl, according to whether the amount of alkali present is sufficient to saturate both the sulphonic and the hydroxyl groups or only the former.—T. A. L.

Dyestuffs [*Green*] *of the Diphenylnaphthylmethane Series, Manufacture of Acid.* O. Imray, London. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 21,596, Oct. 13, 1898.

Green acid dyestuffs for wool and silk which exhaust the bath are obtained, according to this invention, by the action of sulphonating agents on the tetraalkyldiamidodiphenylnaphthyl methanes or their monosulphonic acids and oxidation of the leucosulphonic acids so produced. For example, 12·8 kilos. of naphthalene are well mixed with 27 kilos. of tetramethyldiamidodiphenyl carbinol and slowly added to 200 kilos. of fuming sulphuric acid (20 per cent. SO_3), the mixture being cooled with ice water. After standing for some time at the ordinary temperature, or heating to 50°—60° C., until a sample readily dissolves in water, the melt is poured into water, and limed in order to obtain the calcium salt. The dyestuff is formed from this by dissolving 5 kilos. of the calcium salt in 50 litres of water, and adding the calculated quantity of dilute sulphuric acid, the whole being stirred into a paste containing 2·04 kilos. of lead peroxide. After filtering, the solution of the dyestuff is evaporated to dryness. It forms a copper-coloured powder, readily soluble to a green solution in water, and is not precipitated by salt. The shades obtained are a level green fast to washing and light.—T. A. L.

Dyestuffs [*Green*] *of the Diphenylnaphthylmethane Series, Manufacture of.* O. Imray, London. From The Farbwerke vormals Meister, Lucius and Brüning, Hoechst a/Main, Germany. Eng. Pat. 21,839, Oct. 17, 1898.

According to Eng. Pat. 14,621 of 1890 (this Journal, 1891, 761), dyestuffs are obtained from tetra-alkyldiamidodiphenyl carbinols and the α- and β-monosulphonic acids of naphthalene, but owing to their small affinity they have no technical value. The patentees now find that, contrary to what has been stated, the disulphonic acids of naphthalene under suitable conditions, condense with diphenyl carbinols to form leuco-disulphonic acids which, on oxidation, yield new dyestuffs, having valuable properties. For example, 27 kilos. of tetramethyldiamido-diphenyl carbinol and 39 kilos. of sodium 2·2′-naphthalene disulphonate (85 per cent.) are well mixed and stirred into 200 kilos. of sulphuric acid monohydrate with constant agitation. After heating on the water-bath until a sample dissolves readily in dilute ammonia, which takes about 5—6 hours, the melt is poured into water and converted into the calcium or sodium salt. In order to oxidise it, 5 kilos. of the leuco salt are dissolved in 40 litres of water, mixed with the theoretical quantity of sulphuric acid and poured into 2·04 kilos. of lead peroxide and water. After filtering from lead sulphate, the solution is evaporated to dryness. The dyestuff forms a coppery powder readily soluble in water, and dyes wool a level green from an acid-bath, fast to washing and light. Other dyestuffs can be obtained by varying the constituents, and it is to be noted that the ethyl compounds dye yellower shades of green than the corresponding methyl derivatives. —T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

PATENTS.

Textiles or Vegetable Fibre, A Washing and Bleaching Compound for. F. L. Bartelt, Keynsham, Somerset. Eng. Pat. 17,797, Aug. 18, 1898.

Zinc, or a zinc salt, such as the hydroxide, is dissolved in caustic lye of about 24° Tw., and carbonate of soda, "or any other detergent alkali or potash," is stirred in. When the mass is set, it is broken into small fragments of the size of nuts, or is ground. Soap, or any saponifiable oil or fat may be worked up with the compound, for which cleansing, antiseptic, and bleaching qualities are claimed.—E. S.

Bandaging Material, An Improved Manufacture of Sufficiently Resistant, Blood-stanching. W. P. Thompson, London. From W. J. Teufel, Stuttgart. Eng. Pat. 21,213, October 8, 1898.

Penghawar djambi, which consists of the yellow silky hairs from the fibrous root bases of certain tree ferns growing in Java and Sumatra, very effectively arrests the flow of blood from a wound.

On account of the shortness and brittleness of the fibres, however, it is impossible to weave it into a bandaging or gauze material of sufficient strength. To overcome these difficulties for the manufacture of threads for fabrics and yarns, a thread is spun of cotton, sheep's wool, peat wool or the like, and during the spinning a suitable quantity of Penghawar djambi is mixed with it. For felt-like fabrics, a suitable material is mixed in the same way with the Penghawar djambi.

It is claimed that fabrics and gauzes produced in this way are very useful in warfare as plugs and bandages, that they can be carried by soldiers, and the wounds are not only stanched, but kept aseptic.—C. M.

Mercerisation of Cotton or other Fibrous Materials, Impts. in or relating to Apparatus for the. W. E. Aykroyd, W. H. Aykroyd, and H. E. Aykroyd, Bradford. Eng. Pat. 22,101, Oct. 20, 1898.

This invention is an improvement on Eng. Pat. 30,142, 1897. In that specification the yarns before mercerisation were placed over rollers which had bearings only at their centres. It is found that the pressure due to the shrinkage of the material is so great that the rollers very soon get out of the true, and to prevent this fault, in the present patent, arms are thrown out from the central bearings. These arms are turned up or down, as the case may be, at the extreme ends of the rollers, and the latter journalled into them, thus supplying the necessary support, and at the same time not interfering with the yarn being freely placed on the roller.—C. M.

Fabrics, Woven and other, Paper, Feathers, Furs, and the like, An Improved Product and Process for Rendering, Impermeable. M. G. Olivier, Paris. Eng. Pat. 22,104, Oct. 20, 1898.

A 10 to 12 per cent. solution of paraffin wax (white paraffin) is made in any suitable solvent, such as bisulphide of carbon, toluene, essence of turpentine, &c. To this is added about 1 per cent. of bees wax and also about 1 per cent. of rubber solution or gutta percha. When the whole is thoroughly mixed, fabrics are moistened with a small quantity of the solvent, the mixture then sprayed on, and the fabric quickly passed through squeeze rollers. Another method is to extract the air from the fabrics by a vacuum pump, and then spray on the preparation.—C. M.

Fabrics, Photographic Print, Impts. in. J. A. Harvey, Toronto, Canada. Eng. Pat. 6010, March 20, 1899.

Any finely-woven fabric, linen, cotton, silk, or wool, is coated on the back with a pliable and waterproof composition made from rubber or a rubber substitute, and to the face is then applied the sensitive photographic emulsion. The advantages claimed are, greater strength and durability, no distortion during development and no tendency to fold or roll up, also permanence as against damp.—F. H. L.

Wool, Impts. in Extracting Grease from, and in Apparatus therefor. W. Erben, Philadelphia, U.S.A. Eng. Pat. 11,772, June 6, 1899.

In the process here claimed, the grease is extracted from the wool by means of a heated solvent, the excess of the latter removed by mechanical pressure, and the wool washed with hot water, and again pressed to remove the excess of water, all these operations being successively carried out in a single vessel. Claim is also made for the production of a partial vacuum in the vessel containing the wool prior to the introduction of the solvent or wash-water or both, and for causing a partial vacuum in the mass of wool after the removal of the surplus water.

The special apparatus claimed for carrying out these improvements consists of an extractor or kier provided with a moveable false bottom in the form of a piston or plunger, by means of which the wool is compressed against the top of the vessel after the extraction and washing. With it are connected the vessels holding the solvent and hot water, the pump for creating the vacuum, and the still for recovering the solvent from the first washings. The solvent passes through a special heating apparatus before entering the extractor, and there is a condenser for any vapour that may be withdrawn from the apparatus by the vacuum pipe. Various combinations of different parts of this apparatus are also embodied in a series of claims.—C. A. M.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Chromic Acetate, The Isomeric Forms of. A. Recoura. Comptes Rend. **129**, [4], 208—211.

The "normal" acetate is prepared in the solid state by adding to precipitated chromium hydroxide, which has been well washed and dried by the filter-pump, the calculated quantity of glacial acetic acid. Heat is evolved, and the crystalline mass is dried, first by the filter-pump and afterwards on porous tiles over sulphuric acid. The lilac-grey powder obtained, has the formula $Cr(C_2H_3O_2)_3.5H_2O$, and dissolves in water to a solution identical with that obtained by the reaction of barium acetate on chromium sulphate.

The violet "abnormal" monacid acetate is obtained by the spontaneous evaporation of chromium acetate solution over sulphuric acid in presence of glacial acetic acid. Thin, brilliant, violet plates are formed, of the formula $Cr(C_2H_3O_2)_3.H_2O$, which slowly lose acetic acid, to the extent of one molecule. Alkalis give no precipitate with the solution of this substance, and of the three acetyl groups which it contains, only one is displaceable by acids or alkalis. Cryoscopic experiments also show that it behaves like a monobasic acid containing a complex radicle. The author looks upon it as resulting from the union of the radicle $Cr(C_2H_3O_2)_2$ with a molecule of acetic acid, and calls it chromomono-acetic acid.—J. T. D.

Calico Printing, Use of Stannous Sulphocyanide in. L. Caberti. Rev. Gén. des Mat. Col. 1899, **3**, [31], 237—240.

Reference is made to the work of Elb (Oesterreichische Wollen u. Leinen-Ind.) and Wolff (this Journal, 1898, 43), and to a circular issued by the Elberfeld Farbenfabriken, upon the use of stannous sulphocyanide as a discharging agent for azo dyestuffs.

Besides the sodium bisulphite zinc discharge mixture, which it is almost impossible to print satisfactorily, two tin discharge mixtures are employed in discharging azo dyestuffs on cotton tissues, namely, one containing stannous chloride and sodium acetate and the other stannous hydrate. The former of these has the disadvantages of giving a yellowish white and of endangering the strength of the fibre, but, on the other hand, it is readily prepared and applied, and is inexpensive. The latter mixture does not injure the fibre, but it is difficult to print on account of the presence in it of an insoluble pigment, and is expensive. Another tin compound, stannous ferrocyanide, has been proposed. It, too, is a pigment, and is costly, and for these reasons it is not likely to be much used, although it gives a discharge which is free from any tinge of yellowness.

The printing mixtures prepared with stannous sulphocyanide are less costly than any of the above. They impart to the tissue in most cases a slight buffy tinge, which can frequently, however, be removed by a passage through hot water and chalk. Even on prolonged steaming, they do not appreciably affect the tenacity of the fibre. The proportion of the salt required to produce a discharge is less than that of any other tin salt in use. Thus, a mixture of 10 litres of starch paste, 1·5 kilos. of stannous chloride, and 550 grms. of ammonium sulphocyanide ("white discharge S"), costing 0·44 lira per litre, is as effective in discharging as a mixture of 10 litres of starch paste, 2·5 kilos. of stannous chloride, and 1·25 kilos. of sodium acetate, which costs about 0·56 lira per litre. Further, with the stannous sulphocyanide discharge mixtures, a single passage of the fabrics through an aniline-black steam ageing machine is generally sufficient to produce a discharge, while, in the case of the stannous chloride-acetate mixture, two such passages have, as a rule, to be given.

Stannous sulphocyanide readily discharges a number of cotton azo dyestuffs which could not hitherto be satisfactorily discharged with stannous chloride-acetate, such as, for example, Diamine New Blue G, Diamine Sky Blue, Diamine Jet Black SS, Diamine Bordeaux G, Diamine Scarlet 1 B, and Deltapurpurin 5 B; after these, in some instances, have been diazotised upon the fibre and combined with β-naphthol, &c.

An economic production of the manganese bronze discharge style is also possible. The fabrics are padded in a solution of 600 grms. of potassium bichromate in 9 litres of water, 1,050 grms. of manganese chloride in 2·5 litres of water, and 1,540 grms. of sodium acetate, as recommended by Balanche (this Journal, 1884, 255), the last-named salt being added immediately before the solution is used, as this does not keep long. The fabrics are then printed with a mixture of 1 litre of gum tragacanth paste (60 : 1,000), 1 litre of starch paste, 500 grms. of stannous chloride, 300 grms. of ammonium sulphocyanide, 0·5 litre of a saturated solution of tartaric acid, 500 grms. of dextrin, and 240 grms. of ammonium oxalate, for a white discharge; and with mixtures of this and New Methylene Blue N, Rhodamine 6 G, Persian berries' extract, Malachite Green, and similar dyestuffs, with the addition per litre of printing colour of 100 grms. of tannic acid and 100 grms. of a saturated solution of tartaric or citric acid, for colour discharges. The printed fabrics are passed once or twice through an aniline-black steam ageing machine. They are washed at 50°—60° C., and are soaped and dried.

The printing style introduced by Pluzanski (this Journal, 1897, 438) can be advantageously produced by substituting the "white discharge mixture S" for the mixture employed by Pluzanski, which is capable of discharging only pale shades of colours.—E. B.

Hats, Black Dyeing of. E. Frankl. Färber-Zeit. **10**, [13], 207—208.

By dyeing hats with Naphthylamine Black 4 B alone, or in combination with Naphthol Blue Black (Cassella), a level black is obtained, which is thoroughly dyed through and completely fast to light and water.

No bleeding occurs in the re-modelling of the hats, but, if it does, it is a sure sign that the dyestuff has not been properly fixed.

The author recommends the following process:—

Before dyeing, the bodies are well wetted-out in boiling water. Hats which have been milled with alkalis are dyed with 5 per cent. of acetic acid, 10 per cent. of Glauber's salt, and the requisite amount (14 per cent.) of dyestuff. The bodies are entered into the dyebath at 38° C., which is brought to boiling in ½ hour. After this time they are mostly dyed through, but the bath is exhausted by adding 5—6 per cent. of sulphuric acid in several portions, after diluting with water, and boiling.

In order to get a deep black colour, Tropaeolin O O or Indian Yellow G are employed with the black dyestuff, but never more than 2 per cent. is taken, since over this amount would give the black a greenish tinge.—J. E. H.

PATENTS.

Dyeing Textile Materials, Impts. in, and Apparatus for that Purpose. L. J. P. Damons, Roubaix, France. Eng. Pat. 14,960, July 7, 1898.

The materials to be dyed are packed between perforated plates in a suitable dye-vessel, and are treated thus with the necessary solutions, which are forced to and fro through them by steam, air, or gas pressure from one liquor vessel to another. The change in the course of the dye-liquors is effected automatically by means of suitable mechanism, which is described in the original specification.—E. B.

Dyeing Fabrics, Yarns, and Threads; An Improved Process for. B. J. B. Mills, London. From Mercier and Chaumartin, Lyons, France. Eng. Pat. 16,390, July 27, 1898.

With the object of producing multi-coloured effects in tissues composed either entirely of one kind of fibre or of mixtures of different kinds of fibres, some of the fibres are prepared, either before or after weaving, with stannous or stannic tannate. They are then dyed in one or more baths, different colours or shades of colour being obtained on the prepared and unprepared fibres. Thus, a fabric composed entirely of silk is first dyed blue in a bath of Methylene Blue; the colour is removed from the unprepared parts by a "polishing" process, and these parts are then dyed pink in a bath of Rhodamine, without the blue colour of the other parts being appreciably affected.—E. B.

Striped Effects on Textile and other Fabrics, Impts. in the Process of and Means for Producing. C. H. Taylor, Manchester. Partly from J. Santoux, Lyons, France. Eng. Pat. 14,758, July 5, 1898.

The fabrics are passed over a table underneath vessels (tubes or boxes) provided with outlets, of sizes corresponding with the stripe-patterns it is desired to produce. The vessels are connected by pipes with reservoirs from which a continuous supply of the colour- or discharge-mixtures is obtained. They are pressed upon the fabrics by means of springs.—E. B.

Dyeing or Printing on Leather, An Improved Process for. E. Peltzer, P. Peltzer, and G. Peltzer, Renoupré-Verviers, Belgium. Eng. Pat. 6515, March 25, 1899.

A drawing is prepared on paper or other suitable material in soluble colours, and is transferred by pressure to the leather, after the latter has been moistened with water and stretched.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Salt Production in Siberia. F. Thiess. Eng. and Mining J. 1899, **68**, [8], 217.

In Western Siberia the only local sources of salt are the innumerable salt lakes scattered over the Government of Tobolsk, in the south-west of the Government of Tomsk, and in the provinces of Akmolinsk and Semipalatinsk. In the northern portion of this territory, in the Barabinsk and Kulundinsk steppes, the salt obtained from the lakes is always admixed with other compounds, such as sodium sulphate, but in the southern portion, in the waterless steppes of Akmolinsk and Semipalatinsk, a very pure salt is obtained, which is available for edible purposes. In 1896, 11,834 tons of salt were taken from one lake, that of Karyakovsk, but this is by no means the greatest amount produced in one year, and moreover the official statistics represent only about a quarter of the actual output, as the Kirghiz nomads are allowed by the authorities to take as much salt from the lakes as they choose.

Glauber's salts are obtained from the Great and Little Marmishansk lakes in the Government of Tomsk, 125 miles south-west of Barnaul, the annual production averaging 1,640 tons.

Common salt occurs in abundance in Eastern Siberia, mainly as deposits of rock salt, but only in sparsely-populated districts, and is, therefore, at present only worked on a small scale.

The output of salt from Siberia from 1887—1896 (both years inclusive) has averaged 35,000 tons per annum.

—A. S.

Boric Acid and Borax, Preparation of. — Bigot. Rev. Prod. Chim. **2**, [11], 163.

To obtain the boric acid, the author subjects, say, 100 parts of calcium borate and 150 parts of an ammonium salt (sulphate) to prolonged heat in a closed vessel, the ammonium borate first formed subsequently splitting up into boric acid and ammonia. The latter is condensed and collected, the former being dissolved out of the residue by water and crystallised by evaporation.

To prepare borax, two molecules of ammonia and one molecule of sodium nitrate are added to two molecules of boric acid, and when the mixture has been heated it is dissolved in a minimum quantity of water. The ammonium nitrate thus obtained as a by-product can be readily purified. This method dispenses with the necessity for employing sodium carbonate.—C. S.

Alkali Chloride Solutions, Electrolysis of. Foerster. Zeits. für Elektrochem. 1899, **6**, 11—23.

In an address delivered before the German Electro-Chemical Society the author gives an historical and critical account of investigations on the electrolysis of alkali chloride solutions by Oettel (this Journal, 1895, 492; 1898, 769—770), Foerster and Jorre (this Journal, 1899, 272), Haber (Zeits. f. anorg. Chem. **16**, 198 and 329), Wohlwill (this Journal, 1898, 923—924), Winteler (this Journal, 1898, 1145), together with some original work by Müller.

In conclusion, he points out that during the electrolysis of such solutions, complicated reactions take place, and that it is at present impossible to decide which of the views put forward by the different investigators is the correct one.

As regards the electrolytic production of chlorates, the following points are of importance:—

1. Suppression of cathodic reduction, *e.g.*, by the formation of calcium hydrate or, according to Müller (Zeits. f. Elektrochem. **5**, 469), by the addition of potassium chromate to the solution.

2. Slight acidification of the solution for the purpose of producing free hypochlorous acid.

3. The use of a sufficiently large volume of solution in relation to the current strength and good circulation of the electrolyte in order to complete as far as possible the secondary processes requiring time.

4. A temperature of at least 40° C. should be used partly to aid in the above object, partly to effect a lowering of the necessary E.M.F., and partly to prevent the formation of perchlorates.

In the technical production of chlorates it is more important to maintain the electrolyte neutral or slightly acid rather than alkaline. Oettel has already shown that in the latter case the current efficiency scarcely reaches 65 per cent., and that this limiting value is accompanied by a rapid evolution of oxygen. In neutral or slightly acid solutions, the chief loss of current is occasioned by the cathodic reduction of hypochlorites, if ions, which are not easily discharged, *e.g.*, those of carbonic acid, are introduced into the electrolyte. This can be accomplished without special diaphragms, and the author is of opinion that the further development of the electrochemical chlorate industry will take place in the direction of perfecting the processes in which neutral or slightly acid solutions are employed. The ideal electrolytic chlorate process would be in the electrolysis of pure calcium chloride solutions, whereby a current efficiency of about 87 per cent. is permanently attained.—J. S.

Borate of Lime, Estimation of Boric Acid in. R. Schwartz. Chem. Zeit. 1899, **23**, [47], 497.

See under XXIII., *page* 864.

Chrysean from Potassium Cyanide. G. Hellsing. Ber. **32,** [9], 1497.

See under XXIV., *page* 870.

Ozone, Sterilisation of Water by Means of. E. J. McWeeney. J. State Medicine, 1899, **7,** [8], 462. From Th. Weyl. Centralbl. für Bakt. **26,** [1].

See under XVIII. B., *page* 851.

PATENTS.

Sulphuric Anhydride, Impts. in the Manufacture of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 15,947, July 21, 1898.

Modifications are described of the well-known process of preparing sulphuric anhydride.

It has been found that the impurities ordinarily contained in the gases from burning pyrites have a most injurious effect on the platinised asbestos or other contact substance used. The most injurious of these impurities are arsenic, phosphorus, and mercury, and their compounds; besides which sulphuric acid in the state of mist is present, even in the gas derived from burning sulphur, and this, when of a certain strength, is destructive to the apparatus. To effect the purification of the roaster gases, they are, after the usual passage through a dust flue, treated with a jet of steam, and are then subjected to a gradual cooling, followed by repeated washing with water or sulphuric acid, and are finally dried by sulphuric acid. Before passage to the contact apparatus the gases must be subjected to an optical and to a chemical test. The optical test consists in examining a layer of the gas some yards in length, illuminated at the further end, to see that it is dust-free. To detect the impurities, the gas is passed through water for about 24 hours, and the liquid is then examined.

The next set of improvements have for their object the equalisation and regulation of the temperature of the gases passed through the contact substance. When SO_2 and O combine to form sulphuric anhydride, 32·2 calories are set free, and the temperature rises quickly to a point at which a reverse action sets in, SO_3 decomposing into $SO_2 + O$. To prevent this, arrangements are made for heating the gases up to the most favourable temperature for initiating the reaction; and for cooling the contact substance to the required extent. The apparatus, in its simplest form, consists of a tube the lower portion of which is occupied by the contact substance, the upper portion, at which the gases enter, being left free. This tube is enclosed within an outer tube or brickwork, in which are gas flames to assist in supplying heat, and through which either air or the gases for the reaction are passed, for cooling or for heating the inner tube, as need may be. A battery of such tubes is used, supplied with chambers for subdividing and mixing the gases, which are preliminarily passed through temperature regulators. The mixture of sulphur dioxide and of oxygen or air, being brought to a suitable temperature, is passed into the central tube, the charged portion of which is being cooled (when necessary) by the gases passing into the outer tube at its lower end.

The third main object of the invention is to so arrange the contact matter that the gases may traverse it with facility, with a minimum pressure. This is effected by arranging the contact mass in the tube in separate compartments by means of perforated plates, kept apart by the insertion of short central tubes, so that there is a clear open space in each compartment.—E. S.

Sulphuric Anhydride, Impts. in the Manufacture of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 15,948, July 21, 1898.

The following substances are stated to occur as possible impurities in the sulphurous gases from burning pyrites: iron, manganese, copper, nickel, arsenic, antimony, phosphorus, mercury, lead, zinc, bismuth, thallium, and selenium, or their compounds; arsenic, phosphorus, and mercury being the most injurious of these, since they render the contact substance almost inert. The method of purification consists in treating the hot gases with a jet of steam in the dust flue; the gases are then passed through a flue, and then into a system of lead pipes arranged to act as a cooler, where the temperature is lowered to about 100° C. The gases are then, preferably, passed through a series of wash bottles, the water in which becomes converted into dilute sulphuric acid. The gases are finally dried by concentrated sulphuric acid, and their freedom from dust and chemical impurities ascertained by the means described in the abstract immediately preceding.—E. S.

Sulphuric Anhydride, Impts. in and Apparatus for the Manufacture of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 15,949, July 21, 1898.

The improvements relate to the manufacture of sulphuric anhydride by the contact process, and consist in subjecting the contact mass to a regulated cooling, so as to remove the excess of heat due to the reaction. The process described and the apparatus figured are substantially those given in Eng. Pat. 15,947, 1898, in a preceding abstract. —E. S.

Sulphuric Anhydride, Impts. in the Manufacture of, and Apparatus for use therein. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 15,950, July 21, 1898.

The claims are for "the manufacture of sulphuric anhydride by the contact process, consisting in so constructing the apparatus that it can be worked at pressures differing but little from atmospheric pressure, the same being attained by arrangement of the contact mass so that it is capable of being effectively cooled, and the layers of which it consists are supported so that they cannot press upon one another, and no other path is open to the gases except through the contact mass." And, for use of a vessel for containing the contact mass, "having supported at intervals in its interior, perforated or reticulated trays or plates, which support layers of the contact mass, the gas passing through the contact mass at approximately atmospheric pressure." The process and apparatus are substantially those given in Eng. Pat. 15,947, 1898. (See last abstract but two.)—E. S.

Sulphurous Acid, Sulphuric Acid, and Sulphuric Anhydride; Impts. in the Manufacture of. G. W. Johnson, London. From Verein Chemischer Fabriken, Mannheim, Germany. Eng. Pat. 17,266, Aug. 10, 1898.

Pyrites is burnt in an ordinary pyrites furnace, to which air is admitted, previously heated and thoroughly dried. The hot roaster gases are at once conducted over a contact substance containing ferric oxide (preferably fresh burnt pyrites waste), placed in an oxidation chamber to which external heat is not applied. This process is stated to give a good yield of sulphuric anhydride.

It is stated that "the pyrites waste affords an excellent means for extracting, in a technically perfect manner, the arsenic from sulphurous gases containing arsenic, so that" "a large yield, free from arsenic, is obtained from the initial materials containing arsenic if, in passing the gases over the burnt ore, the production of comparatively large quantities of sulphuric acid be, as much as possible, avoided." —E. S.

Nitrous Gases, Impts. in or relating to the Recovery of, in the Manufacture of Sulphuric Acid. A. J. Boult, London. From A. F. Izidore and M. Biscons, Toulouse, France. Eng. Pat. 19,907, Sept. 20, 1898.

The apparatus is intended to replace Gay-Lussac towers in new works, or it may be used to recover nitric acid from the gases escaping from the towers in old works. A lead conduit of cylindrical or prismatic shape may be secured, at a suitable angle, at the walls of the lead chambers, and is provided with barriers at intervals, on the bottom, which is covered by a layer of sulphuric acid constantly circulating in cascades from barrier to barrier in a direction opposite to that of the gases coming from the chamber. Baffle plates are arranged at the bends, to ensure contact between the acid and the gases. A current of air is supplied by a blower in the direction of the movement of the gases. The sulphuric acid at 60 B. is supplied to the apparatus from a reservoir, and another reservoir receives the nitrous sulphuric acid as it forms. It is stated that by this apparatus "**all nitrous products are thus arrested, and become** utilisable for the oxidation of sulphurous acid at the entrance of the chambers." A form of the apparatus is shown which may be adapted to existing works without reconstruction.—E. S.

Sulphuric Acid, Impts. in the Manufacture of. A. J. Boult, London. From The Pratt Process Company, Atlanta, U.S.A. Eng. Pat. 10,757, May 23, 1899.

A COMPLETE plant for the manufacture of sulphuric acid is shown and described, in which the salient feature is "the employment of means for effecting rapid return of the partially spent gases from any part of the apparatus towards its rear, back toward the front thereof, and the mechanical projection and thorough admixture of such returned gases with the freshly entering gases or acid-making materials from the generators, either before or after entry of these latter gases into the apparatus, whereby intimate mixture of such gases will be effected, resulting in rapid and continuous precipitation of sulphuric acid." A direct pull or suction is obtained on the furnace and Glover tower, with pressure on the remainder of the system, by use of a fan or blower and of suitably located dampers. The acid chamber may be either a single chamber, or two or more connected chambers; the lead chamber and cooling chamber may have communicating columns to arrest the gases on their entry and cause precipitation. Four modifications of the apparatus are described in all, the object being to accelerate and increase "the production within a given acid-producing space" by the means indicated.—E. S.

The Light Metals (Potassium, Sodium), and Anhydrous Oxides and Peroxides and Cyanides of these Metals; A Process for the Production of. G. Wolfram, Rödelheim, Germany. Eng. Pat. 18,604, Aug. 30, 1898.

THE alkali metals are produced from their dry hydroxides by fusing them with calcium carbide or an alkali-metal carbide in a suitable iron vessel provided with a distilling-off and condensing device. From 45 to 48 parts of sodium are stated to be thus obtainable from 100 parts of sodium hydroxide.

Anhydrous alkali oxides are produced by fusing an alkali hydroxide with a suitable carbide, and allowing the vapour of the alkali metal set free, to drip back into the reaction vessel; if alkali peroxides are to be obtained, oxygen is passed through the mass.

To obtain alkali cyanides, the same process is used as in obtaining peroxides, except that instead of oxygen, nitrogen, or a mixture of nitrogen and of carbon monoxide, is passed through the fused mass. Potassium cyanide is obtained, preferably by adding yellow prussiate of potash to the molten mass, evolving alkali metal vapours, obtained by fusing an alkali hydroxide with a suitable carbide, the alkali metal being prevented from escaping. The potassium and sodium cyanides thus produced may be separated from the melt "in the usual manner."—E. S.

Cyanides and Ferrocyanides, Impts. in and Apparatus for the Manufacture of, from Sulphocyanides, and the Recovery of By-Products. J. Raschen, and The United Alkali Company, Limited, Liverpool. Eng. Pat. 19,767, Sept. 17, 1898.

THE process, as described in the first claim, is for the "manufacture of cyanides and ferrocyanides from sulphocyanides, by causing the sulphocyanide, together with nitric acid, to pass through a series of decomposers to which steam is admitted, from which the gases and vapours evolved are passed through a water wash-tower, and thence to a condenser, and thence to absorbers containing caustic alkali, or alkaline earth, by which the hydrocyanic acid is absorbed, the nitric oxide passing through a tower, or towers, in which it becomes converted to nitric acid, and is returned to the decomposers for re-use in the process, the liquor from both the aforesaid water wash-tower and condenser being conducted back to the decomposers." The apparatus consists of a combination of decomposers with inlets for the materials and for steam, and communications for the gases and vapours to a water wash-tower and to the other connected vessels included in the description of the process.—E. S.

Sodium Carbonate and other similar Salts, A New or Improved Process and Apparatus for Crystallising in Small Crystals. J. Dekker, Wormerveer, Holland. Eng. Pat. 24,978, Nov. 26, 1898.

A NUMBER of flat sheet-iron pans to contain the solution of the salt to be crystallised, are supported in tiers by columns arranged round their peripheries, and a vertical shaft passes through the centres of the pans, carrying paddles, which, as the shaft revolves, keep the liquid in each pan in agitation. Cold air is blown upon the pans by suitable means, or a current of air may be established over the surfaces by suction, in which case each pan is closed at its upper part. This process of crystallisation is stated to be very rapid.—E. S.

Ozone, Sterilisation of Sewage by Means of, An Improved Process and Apparatus for. M. Otto, Neuilly-sur-Seine, France. Eng. Pat. 15,151, July 9, 1898.

See under XVIII. C., *page* 852.

Ozonisers, Impts. in. E. Andreoli, London. Eng. Pat. 20,206, Sept. 23, 1898.

See under XI. A., *page* 840.

VIII.—GLASS, POTTERY, ENAMELS.

Glass, Fusibility of. A. Granger. Monit. Scient. **13**, [2], 541.

THE author bases his study of the subject upon the observation of the following three temperatures: (*a*) the temperature at which triangular glass prisms of given size soften and sink by their own weight on heating in a muffle; (*b*) the annealing temperature; (*c*) the tempering temperature. The results of a large number of observations made with different descriptions of glass are given. The temperatures observed in the experiments with the prisms were found to correspond very nearly with the temperatures at which the materials fused to glass. At about this temperature devitrification may easily occur. It is therefore necessary in making such experiments to raise the temperature sufficiently to fuse the crystallised glass, and effect its re-solution in the vitreous portion. The fusibility of silicates and borates varies in the same manner as their dilatation. The addition of silica lessens the fusibility of alkali silicates. In studying annealing, the author examines the glass under polarised light between two Nicol's prisms, glass annealed at the correct temperature being characterised by the extinction of light. An interesting fact revealed by the author's experiments is the proximity of the temperature of tempering to that of annealing.—H. H. B. S.

Glass, Colloidal. C. Barus. Amer. J. Science, 1898, **6**, 270.

THE author, in carrying out experiments on the action of hot water on glass, has succeeded in impregnating glass with water to such an extent that it becomes fusible below 200° C. The clear "water-glass" obtained in this manner, swells up with loss of water when heated over a gas-burner, and is converted into a white porous mass. The author states that glass as a colloid is miscible with water in all proportions; and that such solutions, if sufficiently concentrated, coagulate at ordinary temperatures, the congealed "aqueous glass" resembling ordinary glass in general appearance, and frequently melting below 200° C.—A. S.

Glass, Thermodynamic Relations of Hydrated. C. Barus. Amer. J. Science, 1899, **7**, 1—3.

THERE are two stages in the action of hot water on glass (200° C.). The glass first becomes opaque, and there is relatively great contraction of volume and increase of compressibility. Afterwards the product ("water-glass") becomes more and more clear, the volume contraction falls to zero, and the compressibility, after reaching a maximum, diminishes with great rapidity. On cooling, the product is clear, and as hard and brittle as ordinary glass. A small piece, when held in a candle flame, soon fuses, with loss of water, to a "milk-white pumice."—A. S.

Glass, Moist; Gases Occluded by. F. Mehlhorn. Berlin Phys. Ges. Verh. 1898, **17**, 123—128.

On investigating the absorption of atmospheric air by the thin coating of moisture which, according to Bunsen's researches, adheres to glass until it is brought to a temperature of 500° C., it was found that 80 or even 90 per cent. of the gas thus absorbed consists of carbon dioxide. This explains, to some extent, the persistent occurrence of the spectrum bands of CO in the sparking spectra, since CO is generated by sparking CO_2.—A. S.

PATENT.

Wool, Mineral, Impts. in and relating to. C. Logan, Glasgow. From C. H. Hubbell, St. Louis, U.S.A. Eng. Pat. 12,556, June 16, 1899.

The claims are for a new mineral wool composed of granite combined with a flux, and for the manufacture of the same by melting the granite with limestone, lime, or other alkaline substance, and subjecting a stream of the molten product to a jet of steam, superheated or otherwise, or of air, either hot or cold.—A. W.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Wood Preservatives, The Use of Petroleum Products as. H. Charitschkow. Zeits. für angew. Chem. 1899, [32], 757—760.

The compounds of the heavy metals (especially copper and iron) with petroleum acids, recommended by the author for impregnating railway sleepers, &c., may be prepared from the acids recovered from the waste products obtained in refining petroleum. The copper salt can be produced direct by dissolving the metal (in the form of turnings, &c.) in the purified acids at the ordinary temperature, warmth retarding rather than accelerating the operation. In the case of the other metals, *e.g.*, iron, zinc, or aluminium, the process is one of double decomposition between the sulphate of the metal and the sodium salt (soap) of the petroleum acids, the product being then dissolved in petroleum spirit ("ligroïn"). A typical scheme of arrangement for combining the recovery of the petroleum acids from refinery waste with the manufacture of the neutral iron compound of these acids is given, the iron liquor being prepared by dissolving scrap iron in the waste sulphuric acid, and allowed to react on the waste alkali (petroleum soap). This neutral salt can be converted into an acid salt by the addition of purified petroleum acids in the proportion of 3 parts to 1 part of iron present.

In applying the product as a wood preservative, the author advises steeping the posts, &c., in the preparation in a closed vessel, which is then heated by steam to dry the wood, the expelled water vapour and petroleum spirit being collected and condensed. On shutting off the supply of heat, the wood absorbs the impregnating solution, and, after the excess of the latter has been drawn off, the absorbed solvent is driven off by heat, leaving the metallic salt behind in the pores. About 6 lb. of the copper salt (corresponding to $\frac{1}{3}$ lb. of copper) are required for a railway sleeper, and the entire operation takes about $4\frac{1}{2}$ hours, in three equal stages, as mentioned above.—C. S.

Wood, Impregnation of; Employment of Petroleum Products [Phenols, &c.] for. K. W. Charitschkow. Zeits. angew. Chem. 1899, [31], 737.

See under XVIII. C., *page* 852.

PATENTS.

Wall Plaster, New or Improved Manufacture of Material suitable for, and similar Purposes. W. L. Wise, London. From F. Boas, Quebec, Canada. Eng. Pat. 19,102, Sept. 7, 1898.

The material is composed of 6 to 10 parts by weight of crushed chrysotile serpentine rock (a waste product in asbestos mining), mixed with 1 part by weight of quicklime and sufficient water to slake the lime and reduce the mixture to a plastic mass. The materials are said to react chemically, a double silicate of lime and magnesia being formed. The materials may also be mixed to form a dry powder, which can be made up with water for use as required.—H. H. B. S.

Magnesian Cement, applicable for the Manufacture of Artificial Stone, Emery Wheels, Billiard Ball Compositions, and for other Purposes; An Improved. J. W. Butler, Blackheath, Kent. Eng. Pat. 19,579, Sept. 14, 1898.

The cement is made as follows:—Magnesium chloride is mixed with about an equal bulk of coal ash, and the mixture dried by boiling in a steam-jacketed receptacle. Ground calcined magnesite is then added and to the dry mixture so produced is further added, about 2 per cent. of sulphate of alumina or sulphate of potash and about 2 per cent. of commercial dry soap. The cement is said to be damp-proof, non-contractile, and non-deliquescent.

—H. H. B. S.

Coating Material for Decorating and Building Purposes An Improved. G. Collantier, Paris. Eng. Pat. 19,633, Sept. 15, 1898.

The material is composed as follows:—Grit or gravel, 180 grms.; carbonate of lime, 100 grms.; phosphate of lime, 200 grms.; pumice, 60 grms.; talc, 20 grms.; turpentine, 85 grms.; linseed oil, 55 grms.; oil varnish, 25 grms.; water, 30 grms.; siccative, 25 grms.; white-lead and oil, 220 grms.; total, 1,000 grms. It is applied to the surfaces to be coated in the same way as paint, and is said to impart a stone-like appearance.—H. H. B. S.

Lime, Cement, and like Substances; An Improved Shaft Kiln or Furnace for Burning. F. C. W. Timm, Hanover, Germany. Eng. Pat. 12,663, June 17, 1899.

This invention consists in the provision of a protective metal casing for iron kilns for lime or cement burning, &c., such casing being constructed of several sections lying one above the other, or of separate rings, by which the furnace walls are supported and prevented from cracking.

—H. H. B. S.

Stone, Artificial; Improved Process for Hardening. C. D. Abel, London. From C. Westphal, Berlin. Eng. Pat. 21,073, Oct. 6, 1898.

This invention relates to the process of hardening artificial stone by means of carbonic acid gas. The improvement consists in employing the carbonic acid gas in a pure or highly concentrated state, instead of making use of waste gases for the purpose, containing only a small percentage of carbon dioxide. It is claimed that the heat generated when the gas is used in a high degree of concentration is sufficient to effect the drying of the stone.—H. H. B. S.

Building Stones, Bricks, and like Articles; An Improved Process for the Production of. H. Werths, London. From P. Kleber, Mayence, Germany. Eng. Pat. 1573, Jan. 23, 1899.

One part of ground quicklime is mixed in a mixing machine with 8 to 15 parts of moist sand; by this operation, the partial slaking of the lime is effected. The mixture is now discharged into the hopper of a second mixing machine, where it is allowed to remain for a time, and is then passed into the machine itself and further mixed with just sufficient water in the form of spray to effect the complete hydration of the lime. This being accomplished, a further small quantity of water or milk of lime is added, so as to bring the mass into a plastic condition suitable for moulding, which is carried out by mechanical pressure. The blocks so prepared are placed upon carriages and conveyed to steaming chambers, in which they are hardened by exposure to high pressure steam.—H. H. B. S.

X.—METALLURGY.

Metals, Crystalline Structure of. J. A. Ewing and W. Rosenhain. Proc. Roy. Soc. 1899, **65**, 172—177. (Compare this Journal, 1897, 200 and 507; 1898, 927 and 1111.)

In this paper, which forms the subject of the Bakerian Lecture, the authors deal chiefly with the effects of strain, and the relation of plasticity to crystalline structure.

The effects of strain have been examined in many metals, using surfaces prepared either by polishing or by casting against a smooth plate. When any metal is strained beyond its elastic limit in any way, the surface of each crystalline grain becomes marked by one or more systems of lines running in a generally straight and parallel fashion over it. The direction of the parallel lines changes from grain to grain. Thus these lines serve to mark out one grain from another in a metal which, although polished before straining, has not been etched to develop the boundaries. As straining proceeds, the lines become more and more numerous and emphatic, and two, three, or four systems appear on each grain.

These lines are slips along cleavage or gliding planes in the crystals. The effect of each slip is to develop a step on the polished face. The short inclined surface forming this step, looks black under vertical illumination, but shines out brightly when oblique light of a suitable incidence is thrown upon it. These slip-bands are thus seen as narrow, dark or bright bands, according to the nature of the illumination.

The authors have developed slip-bands in most metals and alloys, and so far as the observations go they occur in all metals.

The slip-bands are in themselves evidence of crystalline structure, and, further, they show how such a structure is consistent with plasticity, and how it persists after plastic strain has occurred. The "flow" or non-elastic strain of a metal occurs through numerous finite slips taking place on the cleavage or gliding surfaces in each of the crystalline grains of which the metal is an aggregate. The elementary pieces which slip on one another, retain their primitive crystalline character.

The slips in metals which exhibit a cubical crystalline structure on etching, are in some instances parallel to the faces of the cubes, and are very frequently inclined to the faces, apparently along the octahedral planes. Stepped lines are frequently seen, and also lines which appear curved probably in consequence of numerous steps which are unresolved even under the highest powers.

When a metal is fractured the grains do not, as a rule, part company at their boundaries, but split along cleavage surfaces. It is to this that the crystalline appearance, obvious in many fractures, is due.

In several metals the authors find that "twinning" takes place in the crystalline structure as an effect of strain. The twinning frequently takes the form of a large number of parallel bands within a single grain, and a twin band due to strain in one grain is sometimes associated with a twin band in neighbouring grains, the bands being continuous except for a change in orientation in passing from grain to grain.

The twinning under strain may be regarded as a result of slip accompanied by a definite and constant amount of rotation on the part of the molecules. From this point of view there are two modes in which plastic yielding occurs in a crystalline aggregate. One is by simple slips, where the movements of the crystalline elements are purely translatory and their orientation is consequently preserved unchanged. The other is by twinning, where rotation occurs through an angle which is the same for each molecule in the twinned group. Both modes are often found not only in a single specimen of metal but in the same crystalline grain.

Eutectic alloys have also been examined. A correlation between the micro-structure of alloys and the variation of electrical conductivity with temperature is also suggested. The high resistance of alloys generally may be ascribed to the large number of joints across which the current has to pass.

The authors regard their experiments as establishing the conclusion that the plasticity of metals is due to the sliding over one another of the crystalline elements composing each grain, without change in their orientation within each grain, except in so far as such change may occur through twinning.—J. S.

Iridium, Purification of. E. Leidié. Comptes Rend. **129**, [4], 214—215.

In purifying iridium by Deville's method of fusion with lead and treatment with acids, the iridium is left with the ruthenium and iron, and any rhodium and osmium that may have been present.

The author mixes this residue, finely powdered, with twice its weight of fused common salt, and heats the mixture to low redness in a current of dry chlorine. On cooling, the mass is treated with water slightly acidulated with hydrochloric acid, the solution filtered, heated to 50°—60° C., and sodium nitrite is slowly added till the solution is neutral to litmus and nitrous vapours are no longer evolved. Sodium carbonate is now added to distinctly alkaline reaction, then a slight excess of sodium nitrite, and the liquid is boiled, cooled, and filtered. The iron, lead, and gold remain behind; the solution contains the iridium, rhodium, and ruthenium as double nitrites, and the osmium as sodium osmiate.

To the liquid, excess of soda is added, and it is distilled, whilst a current of chlorine is passed through; the ruthenium and osmium distil over as peroxides. The liquid from the retort is several times evaporated to dryness with hydrochloric acid, which leaves the rhodium and iridium as double chlorides. This residue is dissolved in water containing chlorine; most of the sodium chloride crystallises out, and the residue, dried at 105° C., is heated in a sulphur bath in a stream of chlorine; the rhodium salt is dissociated, and on treating the cooled residue with water containing chlorine, and filtering, rhodium chloride remains on the filter, whilst the double iridium salt passes through. This is precipitated by excess of ammonium chloride, well washed with strong solution of ammonium chloride, and the dried double chloride of iridium and ammonium is reduced in hydrogen, and cooled in carbon dioxide.—J. T. D.

Separator, Magnetic; The Gröndal Dellwik. E. Primozigh. Oesterr. Zeits. für Berg- u. Hüttenw. 1899, 51. Proc. Inst. Civil Eng. 1899, 65.

Magnetic iron ores containing sulphides, such as copper pyrites and zinc blende, are now successfully treated at Pitkäranta in Finland by a process of magnetic separation, in which, differing from former methods of the same kind, the material is treated wet. The ore, containing 20—25 per cent. of iron, is broken by a rock-breaker and ground to powder (0·5—1·0 mm.) in a mill formed of a water-tight cast-iron drum, lined internally with chilled cast-iron plates, and partly filled with cast steel balls. The ore in lumps of the size of the fist is fed in through a hole at one end, and carried out by a stream of water at the other end. The main features of the separating machine are the two rotating cylindrical parts known as the separator and collector. The former is made up of four ring-shaped electro-magnets connected to a central shaft and separated by brass rings at the ends. For a separating machine capable of treating 25—50 tons (according to the nature of the ore), the separator requires ½ h.p. to drive it and a magnetising current of 8 ampères and 35 volts. The collector is a wooden drum carrying eight concentric series of soft iron points. The stream of ground ore and water is led over the top of the separator, which takes up the magnetic particles. The latter are removed by the attraction of the iron points on the collector, which are temporarily magnetised by induction in passing the electro-magnets, and then, when the magnetic influence ceases, fall off into a collecting box. The waste contains 1—1·5 per cent. of magnetite, and the finished product, 65—71 per cent. of iron. The finely divided magnetite is prepared for the blast furnace by pressing it, whilst still damp, in a briquette press, and subjecting the pressed blocks to a clotting heat, 700°—800° C., for a short time, or by pressing it with 3—5 per cent. of lime and exposing the bricks to the air for about a fortnight.

It is stated that during the period January to September, 1897, the process was worked at Pitkäranta at a cost of about 11*d*. per ton of rough ore treated. The author estimates that the power required for a plant capable of treating 150,000 tons annually would be 125—150 h.p., and the cost, 6,500*l*.—A. S.

Bessemer Process, Application of Hot Blast in the. J. Wiborgh. Jernkontorets Annaler, 1898, 257. Proc. Inst. Civil Eng. 1899, 66.

It has been observed that Bessemer converters, blowing iron of the same composition, work somewhat better in summer than in winter, a result probably due to the difference in temperature of the blast at its admission to the converter. The author considers that with a more decided increase of temperature, up to 400° or 500° C., much hotter blows would be realised, and iron considerably lower in silicon could be used, with less wear in the tuyères and a smaller loss on the weight of the charge. It would perhaps appear that the increased volume of blast per unit of time might require either an increase in the larger section or of the blowing power, in order to complete the blow in the required time, but the author thinks this would be compensated by the more rapid combustion, as it is known from the researches of Tamm and Snelus, that at the beginning of, and sometimes all through the blow, the air passes through unconsumed, especially when the temperature of the metal is low, or the bath shallow, and as such waste would be prevented by the hot blast, less air would be required. The amount of heat contributed by the blast at 450° C. is 41,800 centigrade units per ton, which, taking the specific heat of melted cast-iron at 0·3, corresponds to a rise in the temperature of the bath of 145° C., or the equivalent in heating power of about 0·5 per cent. of silicon or 0·75 per cent. of phosphorus.—A. S.

Martin Process (*Acid*) [*Steel*], *Effect of Manganese in the.* F. A. Matthewman. From K. Poech. Stahl u. Eisen, 1899, **19**, 574.

The slag from a charge in which a pig-iron containing 0·5 per cent. of Mn had been used, was found to contain 3·83 per cent. of Mn, although pig-irons with 1·2 per cent. of Mn and 2·75 per cent. of Si gave on an average 13 per cent. of MnO in the slag. Hence, with a charge of 20 per cent. of scrap (containing 0·5 per cent. of Mn) and 80 per cent. of pig-iron, with ore additions (containing 1·25 per cent. MnO), amounting to 20 per cent. of the iron charged, and on the assumption—not strictly correct—that all the manganese passes into the slag, the slag is calculated to contain 59·6 per cent. of SiO_2, 5·9 per cent. of Al_2O_3, 25 per cent. of FeO, and 9·5 per cent. of MnO. In American practice, and when cast-steel with 2 per cent. of Mn is used, the slags often contain over 20 per cent. of MnO; but in medium cases an average of at least 10 per cent. may be expected. But little regard is paid to the proportion of manganese in the ore, most of that in the slag coming from the pig-iron; and it is desirable that the pig-iron should contain at least 0·5 per cent. of Mn in order that advantage may be taken of the fusibility of the [complex] manganese silicates. The author maintains, in opposition to English opinion, that the furnace charges with higher percentages of manganese come the more rapidly to the boil. When charges with but little manganese are melted in the pig-and-scrap process, and ore and hammer slag are added at the right moment, the hard final product wished for, is obtained with a comparatively small expenditure of deoxidising substances and little loss of iron. The author opposes the view that a high manganese percentage in the pig-iron of the charge is accompanied by a low furnace yield, and he recommends the use of an iron containing 1 to 2 per cent. of Si and 2 to 3 per cent. of Mn for the acid process. If, in the pig-and-scrap process a low manganese pig-iron has to be used, the difficulty may be met, as in the pig-and-ore process, by the use of iron-manganese alloys. The author considers that a pig-iron with 3 per cent. of Mn has no more serious action on the furnace lining than has the scrap, and attributes the want of durability of the hearths of the Scottish furnaces to the method by which they are made.—W. G. M.

Crucible Steel Works of Braun's Soehne in Schloss Schoendorf, Upper Austria. A. Harpf. Oesterr. Zeit. Berg und Hüttenw. 1899, **47**, 253. From Chem. Zeit. Rep. 1899, **23**, 183.

Since the discovery of the dephosphorising process, the Alpine iron industry has been left behind in competition with other countries. Only the production of certain qualities of steel, particularly for tools, armour plates, and files has maintained the old reputation.

Seven graphite crucibles, seated in a perforated cast-iron plate, are heated in a small cast-steel furnace, and are used once or twice only. They are charged with 18—20 kilos. each, of the raw material, puddled steel or iron, cement-steel, refined iron, wrought-iron, steel cuttings; 150 kilos. of coke being required for every 100 kilos. For extra hard tool-steel, ferrotungsten (with 30 per cent. of tungsten) or ferrochrome or ferronickel is added. Aluminium is used to reduce oxides present; chalk, clay, quartz, or borax are the slag-forming materials. A more modern arrangement permits the arrangement of 9 crucibles with 12—18 kilos. each in one furnace. The hot furnace gas is used to warm another set of crucibles in order to save time and coke. Special mention is made of the manufacture of files.—S. K.

Iron Alloys, Production of, by the Heibling Process. Chem. Zeit. Rep. 1899, **23**, [22], 219. From L'Ind. Électrochim. 1899, **3**, 55.

The Heibling process is intended to produce iron alloys and calcium carbide from a suitable mixture of metallic oxides with lime and carbon. The furnace, which is cylindrical or conical, is of refractory material lined with carbon. The bottom is of cast-iron and rests on a second carbon bottom connected with the negative pole of the generator. The mineral or oxide mixture of the charge is mixed with as many atoms of carbon as it contains of oxygen, and the flux consists of powdered lime mixed with 3 atoms of carbon for every molecule of lime. The weight of the cast-iron bottom (which passes into the alloy) must be reckoned in the charge. An addition of fluorspar is recommended for the separation of silicon. The alloy collects under the calcium carbide, which contains almost the whole of the silicon as carbide.—W. G. M.

Chromium, Behaviour of. W. Hittorf. Zeits. für Elektrochem. 1899, **6**, 6—10.

The author gives an account of further experiments which were made to prove that the passive condition of chromium (this Journal, 1898, 585) is not occasioned by a thin film of oxide as is the case with iron.—J. S.

Copper Ores, Separation of Impurities from, in the Reverberatory Furnace and in the Converter. H. M Howe. Trans. Amer. Inst. Min. Eng. 1899. Through Chem. Zeit. Rep. 1899, **23**, [22], 218.

The author objects to the process introduced by Nicholls and James being termed a "direct process," since it is only a modification of the Welsh ones; especially doe it not deserve the name when contrasted with American blast-furnace practice, and the Manhès converter process. He has himself used the same process in Chili, excepting that he employed native instead of artificial copper oxide. E. Keller (Chem. Zeit. Rep. 1898, **22**, 302) has stated that there are removed :—

——	In the Reverberatory Furnace.	In the Converter.
	Per Cent.	Per Cent.
Lead	99	95—99
Bismuth	54	94—96
Antimony	50	62—73
Arsenic	21	73—91
Selenium and tellurium	60	57—71

But these figures do not truly represent the action of the reverberatory process, since there are by it obtained a large quantity of very pure regulus, and a small proportion of metallic "bottoms" in which the impurities become concentrated; moreover, the numbers do not give the results with each kind of copper. The author calculates that about 8—12 per cent. of the copper originally present, passes into the bottoms, which carry with them for each 1 per cent. of Cu:—

Cu.	As.	Sb.	Bi.	Ni.	Pb.	——
1·0	2·62	2·56	1·35	1	..	Dean.
1·0	1·91	4·02	2·61	..	..	
1·0	5·70	1·68	1·75	..	0·45	Keller.

Keller estimates the separation of the gold and of silver from the sulphide as 58·46 and 4·65 per cent. respectively, whilst Dean found in "bottoms" 41·5 and 100 per cent. of the Au and 15·8 and 31·7 per cent. of the Ag. Hence it is clear that the degree of concentration of foreign metals in bottoms is a very variable one.—W. G. M.

Copper Ores, Separation of Impurities from, in the Reverberatory Furnace and in the Converter. E. Keller. Trans. Amer. Inst. Min. Eng. 1899. Through Chem. Zeit. Rep. 1899, 23, [22], 218.

This is a reply to Howe's comments on the author's previous paper (see preceding abstract). He has found that by dead roasting of ore there are separated for each 1 per cent. of copper, 1·86 per cent. of Zn, 1·88 of Pb, 1·60 of Bi, 8·15 of Sb, 27·16 of As, 2·8 of Te and Se. By the ordinary process of roasting, whereby the sulphur is reduced from 23 to 15 per cent.; 0·18 per cent. of Cu, 0·34 of Zn, 0·34 of Pb, 0·29 of Bi, 1·47 of Sb, 5·0 of As, 0·5 of Se and Te. The numbers yielded by the Nicholls-James process lie between the two. The advantage of this process is shown by examination of the figures illustrating the distribution of the impurities between the sulphide and the bottoms, but the process is of but little value for argentiferous coppers which are afterwards to be refined electrolytically. A diminution in the impurities in the ore is accompanied by a reduction in the grade of concentration in the "bottoms," whilst with a high percentage of impurities, the regulus is impure, and rich in silver, gold alone being completely removed. David's "Selecteur" converter (this Journal, 1898, 1150), was introduced to apply the best selecting process in converter practice. The following numbers are calculated from the result of an under-blown converter-charge.

——	Cu.	Pb.	Bi.	Sb.	As.	Ag.
In the copper or bottoms.	1·0	0·06	0·08	0·48	0·27	1·46
In the sulphide or regulus.	1·0	0·06	0·02	0·22	0·10	0·64

The percentage distribution of copper and impurities is as follows:—

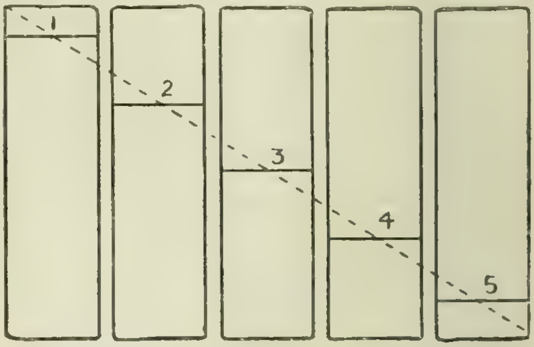
——	Cu.	Pb.	Bi.	Sb.	As.	Ag.
In the copper or bottoms.	44	2·64	3·52	21·12	11·88	64·20
In the sulphide or regulus.	56	3·36	1·12	12·32	5·60	35·80
Removed	0	94	95·36	66·56	82·52	0·0

Hence the bottoms from the converter differ materially from those of the reverberatory furnace. The David process, so far as the removal of impurities is concerned, is less satisfactory than the ordinary converter process, and nothing is to be gained by its use in treating argentiferous coppers for electrolysis.—W. G. M.

Copper, The Sampling of Argentiferous and Auriferous. A. R. Ledoux. J. Canadian Mining Institute, 1899, 2, 108—118.

Argentiferous copper bars are at present sampled by boring, by taking dip samples, or by sawing. The author has found that when 2 to 3 per cent. of arsenic are present, the gold and silver is more concentrated nearer the edges than in the centre of pig copper. Usually the segregation of precious metals is near the centre. In this connection the great variation of the distribution of precious metals in the blister copper of the European market, is well known. A table, giving the assay of 20 samples, shows that, in accordance with the point where the sample was taken, the silver varied from 66·7 to 133·1 oz. per ton, and the gold from 4¼ to 6 oz. The evidence adduced from various assays shows (1) that all gold and silver-bearing copper varies in richness at different points; (2) that while there is no absolute rule, yet, generally, highly refined material free from arsenic has a concentration of the precious metals along the centre line, the maximum being at the middle point of the bar.

In the opinion of the author, the ideal method of sampling is by sawing. It is carried out in the following manner:—



A diagonal line is drawn across five bars. At the point where the diagonal intersects the centre line, the bar is sawn through. It will be apparent that the sawings represent an accurate average sample for the assay.

Buyers and sellers are inclined to accept the "dip" method of sampling if done at their own works. There are obvious disadvantages, for it requires the independent sampler, who is representing the interest of absent parties, to be present during the entire melt. Moreover, in low-grade material, as far as copper contents are concerned, there is always an enrichment and concentration, so that the assay does not represent the material before the melt. There is the fear of the seller that the furnace bottoms have absorbed some of the values, and of the refiner that the furnaces may have given up some precious metal derived from the residue of a former charge. The author urges that, in any case, both buyer and seller should agree in their contracts as to the method of sampling and assay to be employed.—J. L. B.

Boron and Aluminium, Reducing Properties of. Duboin and Gauthier. Comptes Rend. 129, [4], 217—218.

Mixtures of boric anhydride and aluminium, or silica and aluminium, burn when well ignited, with formation of alumina and boron or silicon; but when these mixtures are heated in a stream of chlorine, aluminium chloride only is formed, and B_2O_3 or SiO_2. No chloride of boron or silicon is produced.—J. T. D.

Gold, Assaying Plumbago Crucibles for. F. L. Carter. Eng. and Mining J., Aug. 5, 1899, 155.

See under XXIII., *page* 864.

Metallic Sulphides, Separation of, by Means of Hydrochloric Acid Gas. J. Bird Moyer. J. Amer. Chem. Soc. 1899, 21, 642.

See under XXIII., *page* 864.

Iron, Cast, and Steel; Determination of Carbon in. Rozycki. Rev. Univ. des Mines, Dec. 1898, 300; Proc. Inst. Civil Eng. 1899, 64.

***See under* XXIII., *page* 865.**

Colloidal Metals. A. Lottermoser. Pharm. Zeit. **44,** [47], 411.

***See under* XX., *page* 854.**

PATENTS.

Castings [Iron, Brass, &c.], Impt. in Pickling. A. Gray, London. Eng. Pat. 18,387, Aug. 27, 1898.

The castings are placed in a boiling solution of caustic soda or potash, whereby the scale and sand are dissolved or softened, to be easily removed by rubbing or brushing, &c.—A. W.

Metallic Oxides [Tin, &c.], A Process for the Preparation of. O. Elstner, Gelnhausen, Germany. Eng. Pat. 20,450, Sept. 27, 1898.

The metal, such as tin, is finely pulverised, either in the cold or by melting and dispersing it with a jet of steam, air, or other gas, and is subjected simultaneously to the action of heat and air or oxygen, in a heated space of convenient form for the production of its oxide.—A. W.

Iron, Pig-, An Improved Process for effecting the Preliminary Refining of. L. Pszczolka, Vienna, and R. M. Daelen, Dusseldorf, Germany. Eng. Pat. 21,376, Oct. 11, 1898.

This patent has nine claims for the treatment of pig-iron by running it direct from the blast furnace into a fixed or movable converter, and blowing hot air, or mixed hot and cold air, according to the temperature of the bath and to the quantity of the silicon to be oxidised, into the metal or over it, at or near the upper part of the same. Oxide of iron or other oxidising body, to prevent the bath getting too hot and at the same time to assist oxidation, may also be used, and also manganese, in a metallic state or otherwise, to remove the sulphur after the preliminary refining. The metal is then transferred for further treatment to the basic converter or hearth furnace.—A. W.

Sesquioxide of Chromium, Impts. in the Manufacture of, direct from Chrome Ore. R. W. E. MacIvor and T. F. Spencer, both of London. Eng. Pat. 20,681, Sept. 30, 1898.

Chromium sesquioxide is produced direct from chrome ore by the action of hydrogen or water-gas in a heated reducing chamber as follows:—The finely pulverised ore is heated to at least 700° C., in agitation with the gas, in a rotating furnace or other suitable arrangement, by which means the iron oxide is reduced to metal. The charge is cooled in the gas and passed into acid, which dissolves the iron and leaves chromium sesquioxide.—A. W.

Gold from Auriferous Earths and the like, Improved Apparatus for Sorting or Separating Pulverulent or Granular Substances, more particularly applicable for Extracting. P. Lejeune, Paris. Eng. Pat. 21,164, Oct. 7, 1898.

The apparatus consists of an obliquely inclined table, which slopes more in its transverse than in its longitudinal plane, and to which a percussive or vertical reciprocating motion is imparted. Upon its surface are projecting, longitudinal ribs, which hold back the denser or auriferous particles and guide them to a receptacle at the end of the table, whilst the gangue particles are being jumped and washed down the greater slope towards and over the side. The table may be constructed of a permeable material, such as woven fabric, which may form the upper part of a bellows, the lower part being a movable bottom provided with valves and a suitable means for imparting an up and down motion, whereby air is drawn in and forced through the permeable table, imparting thereto a series of concussions. The whole table, with the end receptacle, is provided with a cover, which has a supply hopper situated above the highest corner of the table.—A. W.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Electro-Chemical Industries, Present Position of. W. Borchers. Zeits. für Elektrochem. 1899, **6,** [3], 61—76.

In order to show the present position of electro-chemical industries the author has endeavoured to collect all available information, and the results are given chiefly in the form of tables.

Table 1 (see next page) indicates those cases where electricity is employed for the extraction of the more important elements. The blank spaces in the table signify that the respective elements are at present obtained without the use of electricity.

Table 2 shows, in a highly condensed form, the contents of another table covering $8\frac{1}{2}$ pages. The expanded table shows under each country the various products made electro-chemically, the names and addresses of the firms engaged in the manufacture, and usually the name of the firm which put down the plant, or the inventor or patentee of the process. In addition, the total available horse-power at most factories, and the horse-power at present being utilised, is shown, and also whether this power is derived from water, steam, or gas.

In Table 2 the total available power only is shown.

Table 2.

——	Total Completed and Projected Sources of Power.			Total Value of Products.
	Water.	Steam.	Gas.	
	H.P.	H.P.	H.P.	Marks.
Africa:—Transvaal	..	454	..	28,896,000
America:—				
Canada	1,500	..	..	450,000
United States........	72,300	11,750	2,500	390,025,760
Europe:—				
Belgium..............	..	1,000	..	594,800
Germany	13,800	16,173	..	55,138,200
England..............	11,500	8,150	20	9,083,600
France	110,140	1,300	..	45,111,340
Italy	29,485	..	..	9,675,000
Norway	31,500	..	..	7,350,000
Austria..............	27,000	23	..	10,967,850
Russia	6,075	1,500	..	4,492,200
Sweden..............	29,000	..	..	8,840,000
Switzerland	38,950	..	..	12,612,650
Spain................	7,100	..	..	2,749,080

Table 3 contains a list of the substances made electro-chemically in the different countries, together with their weights and money values. The values are given in marks, whilst the unit of weight is 1 ton, except for silver and gold, where it is taken as 1 kilo. Owing to contradictory statements as to yield, the author has in all cases taken the lowest values corresponding to practical conditions.

In the case of aluminium the published figures vary a great deal. According to reports on the Heroult process at Neuhausen and La Praz, it appears that 0·5 kilo. of aluminium is produced per horse-power day, whilst at the British Aluminium Company's works the same quantity of aluminium is obtained in a 12-hour day. Calculated on a horse-power year, the first represents an output of 182·5 kilos. of aluminium, whilst the second corresponds to 365 kilos. From information obtained direct from the Pittsburgh Reduction Company, it appears that they turn out 4,500 tons per annum with 7,000 horse-power. This corresponds to 650 kilos. of aluminium per horse-power year.

Now, the quantity of aluminium which is theoretically obtainable per horse-power year, using different potentials at the terminals of the electrolytic bath, is as follows:—

3	volts	723 kilos.
4	"	543 "
5	"	434 "
10	"	217 "

TABLE I.

	Electro-magnetic preparation of crude materials	Manufactured			Electro-magnetic preparation of crude materials	Manufactured	
		Electro-thermally	Electro-lytically			Electro-thermally	Electro-lytically
Al		▤	▤	Na			▤
Sb			▒	Ni	▥		▥
As			▒	P		▥	
Pb	▥		▥	Pt			▥
B		▒		Hg			▒
Cl			▥	O			▥
Cr		▒	▒	S			
Fe	▥			Ag			▥
Au	▥		▥	Si		▤	
K			▤	N			
Co	▥	▒		H			▤
C (Graphite)		▥		Bi			▥
Cu			▥	W		▒	
Mg			▤	Cd	▥		▥
Mn		▒	▒	Sn			▥

Without Electricity.	The Substance can be prepared by Eletricity, or is so prepared experimentally.	Electricity is not employed in all Works for the purpose, or in all the stages of manufacture.	The Substance is exclusively prepared by Electricity.
□	▒	▥	▤

and hence the Pittsburgh Reduction Company must have worked with less than 4 volts, the British Aluminium Company with between 4 and 5 volts, and the other Heroult works with about 10 volts.

As regards the other products, the figures are not so divergent. For each horse-power per annum it may be reckoned that the following quantities can be obtained:—

Copper	16 tons.
Silver	22 ,,
70 per cent. caustic soda (together with 3·5 tons of 38—40 per cent. bleaching powder)	1·6 ,,
80 per cent. caustic potash (together with 3·5 tons of 30—40 per cent. bleaching powder)	1·8 ,,
Potassium chlorate	0·5 ,,
Calcium carbide	1·0 ,,
Carborundum	0·6 ,,

TABLE 3.

—	—	Al.	Au.	Cu.	Ag.	Potassium Chlorate.	Caustic Potash, 80 per Cent.	Caustic Soda 70 per Cent.	Bleaching Powder, 40 per Cent.	Calcium Carbide.	Carborundum.	Various.
Africa:—												
Transvaal....	Weight	..	10,320	..	..	..	..	..	..	..	..	..
	Value..	..	28,896,000	..	..	..	..	..	..	..	..	..
America:—												
Canada	Weight	..	..	..	..	..	..	..	..	1,500	..	..
	Value..	..	..	..	..	..	..	..	..	450,000	..	..
United States	Weight	5,000	7,000	150,000	1,400,000	330	..	5,120	11,200	60,000	560	Ni 182·5
	Value..	10,500,000	19,600,000	225,000,000	113,400,000	216,150	..	783,360	1,120,000	18,000,000	560,000	456,250
Europe:—												
Belgium	Weight	..	..	..	..	..	..	1,600	3,500	..	..	..
	Value..	..	..	..	..	..	..	244,800	350,000	..	..	..
Germany	Weight	..	4,000	13,600	75,000	120	17,280	2,600	51,200	12,444	225	White lead 2,500
	Value..	..	11,200,000	20,400,000	6,075,000	78,600	6,393,600	397,800	5,120,000	3,733,200	225,000	1,125,000
England	Weight	1,000	..	..	..	..	..	11,200	24,500	8,100	..	Na 260*
	Value..	2,100,000	..	..	..	..	..	1,713,600	2,450,000	2,430,000	..	1,170,000
France.......	Weight	6,120	..	..	..	6,300	..	45,280	99,050	35,000	800	..
	Value..	12,852,000	..	..	..	4,126,500	..	6,927,840	9,905,000	10,500,000	800,000	..
Italy.........	Weight	..	..	560	..	..	..	..	..	29,450	..	..
	Value..	..	..	840,000	..	..	..	..	..	8,835,000	..	..
Norway......	Weight	..	..	..	..	..	..	..	..	24,500	..	..
	Value..	..	..	..	..	..	..	..	..	7,350,000	..	..
Austria	Weight	..	..	1,000	..	750	..	7,200	15,750	21,000	?	..
	Value..	..	..	1,500,000	..	491,250	..	1,101,600	1,575,000	6,300,000	?	.
Russia	Weight	..	..	1,200	..	..	..	2,400	5,250	6,000	..	..
	Value..	..	..	1,800,000	..	..	..	367,200	525,000	1,800,000	..	..
Sweden	Weight	..	..	..	..	2,000	..	.	..	25,000	..	..
	Value..	..	..	..	..	1,310,000	..	..	..	7,500,000	..	..
Switzerland..	Weight	810	..	..	..	1,850	..	3,300	7,200	28,250	..	..
	Value..	1,701,000	..	..	..	1,211,750	..	504,900	720,000	8,475,000	..	..
Spain	Weight	..	..	..	..	..	..	3,860	7,350	5,000	..	..
	Value..	..	..	..	.	..	..	511,000	735,000	1,500,000	..	..

* Total production for the United States, England, and Germany.

As far as can be judged from preliminary estimations, the plant which is already in operation, together with that which is about to be laid down, can therefore produce the quantity of products shown in Table 4.

The total value of these products is also given, and the distribution of these over the different countries can easily be ascertained from Table 2.

TABLE 4.

—		Weight.	Price per Ton.	Total Value.
			Marks.	Marks.
Aluminium	Tons	12,930	2,100	27,153,000
Gold.................	Kilos.	21,320	2,800	59,696,000
Copper..............	Tons	166,360	1,500	249,540,000
Sodium	„	260	4,500	1,170,000
Nickel	„	182·5	2,500	456,250
Phosphorus..........	„	?	1,000	..
Silver................	Kilos.	1,475,000	81	119,475,000
Zinc..................	Tons.	?	560	..
Caustic soda, 70 per cent.	„	82,060	153	12,555,180
Caustic potash, 80 per cent.	„	17,280	370	6,393,600
Bleaching powder, 38—40 per cent.	„	225,000	100	22,500,000
Potassium chlorate ..	„	11,350	655	7,434,250
White lead...........	„	2,500	450	1,125,000
Calcium carbide	„	256,244	300	76,873,200
Carborundum........	„	1,585	1,000	1,585,000

As regards water power, France at present occupies the first place, and utilises more water power than the United States. Germany in this respect is very badly off. By combining water and steam power she only occupies the eighth place. If, however, the different countries are arranged, not in the order of the power they possess, but in the order of the value of the products they manufacture electro-chemically, then the United States occupies the first place, Germany the second, and France the third, whilst England occupies, according to this list, the *eighth* place.

—J. S.

"Amphoteric Electrolytes" and "Inner Salts." G. Bredig. Zeits. für Elektrochem. 1899, **6**, [2], 33—36.

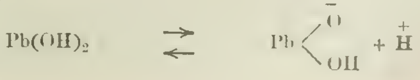
THE term *"amphoteric electrolyte"* is used by the author to indicate any substance which in aqueous solution possesses both an acid and a basic character, or which can split off or combine with both $\overset{+}{\mathrm{H}}$ and $\overset{-}{\mathrm{OH}}$ ions. The general dissociation scheme for the acid function is:— $\mathrm{ROH} \rightleftarrows \overset{-}{\mathrm{RO}} + \overset{+}{\mathrm{H}}$, whilst for the basic function it is $\mathrm{ROH} \rightleftarrows \overset{+}{\mathrm{R}} + \overset{-}{\mathrm{OH}}$. The behaviour of any such substance which reacts with bases according to the first formula and with acids according to the second, may be termed *"electrolytic tautomerism."* Such substances are met with frequently in chemistry, *e.g.*, the oximes $\mathrm{R} - \mathrm{N} - \mathrm{OH}$ form salts both with bases and with acids, and the diazonium hydrate of Hantzsch and Davidson behaves in a similar way. In inorganic chemistry the following substances may be mentioned:—Aluminium hydroxide, zinc hydroxide, stannic acid, arsenious acid, antimonious and antimonic acids. Lead hydroxide is specially interesting in connection with the theory of secondary batteries. An amphoteric electrolyte must, therefore, in acid solution migrate as a cation to the cathode, whilst in alkaline solution it must behave as an anion and migrate towards the anode. This, in the case of the lead salts, has been proved to take place by Liebenow. As a base, lead hydroxide dissociates according to the formula—

$$\mathrm{Pb(OH)_2} \rightleftarrows \overset{++}{\mathrm{Pb}} + 2\overset{-}{\mathrm{OH}}$$

whilst as an acid the dissociation is represented by the formula—

$$\mathrm{Pb(OH)_2} \rightleftarrows \overset{--}{\mathrm{PbO_2}} + 2\overset{+}{\mathrm{H}}$$

or—



Amphoteric electrolytes also play an important part in physiological chemistry. Albumin can neutralise both sodium hydroxide and hydrochloric acid, and this property of the albumins obviously accounts for the dyeing of wool, both by acid and basic colouring matters, *e.g.*, Rosaniline, Eosine, and Picric acid.

The following substances are also amphoteric electrolytes:—Asparagin, leucine, tyrosine, thetine, betaine, glycocoll, sarcosine, anthranilic acid, diazobenzene sulphonic acid, Methyl Orange, Congo Red, &c.

In this preliminary communication the author lays down the general laws governing amphoteric electrolytic dissociation, and then points out an apparent paradox in the case of the "*inner salts*" and anhydrides which yield Küster's so-called "*hermaphrodite*" ions. The hydrochlorides and sodium salts of glycocoll, sarcosine, and betaïne, are all hydrolysed, and when the two series are arranged according to the extent of the hydrolysis they are found to occur in the same order. From this it follows that the stronger acid is also the stronger base. The behaviour of the indicator Methyl Orange is also discussed.—J. S.

Battery, New Primary. [*Harrison Cell.*] J. D. Darling. J. Franklin Inst. 1899, **148**, [1], 55—65.

The Harrison cell consists of a positive element of amalgamated zinc and a negative element of hard lead surrounded by a mass of compressed peroxide of lead prepared by electrolysis. The electrolyte is dilute sulphuric acid (1 : 6). It is an open circuit primary cell, and its E.M.F. is from 2·4 to 2·5 volts, and the internal resistance averages 0·15 ohm.—J. S.

Electrical Resistances, Use of Mixtures of Plumbago and Clay for. J. A. Fleming. Electrician, **43**, 492—494.

In the years 1891–92 the author was carrying out some experiments demanding the use of a non-inductive resistance across a 10,000-volt circuit.

Various dry mixtures contained in tubes were tried, among others the following:—Chalk and rusty iron filings; plumbago and magnesia; plumbago and chalk; plumbago and steatite. None of these mixtures were successful. Finally a mixture of plumbago and Stourbridge clay was adopted; and rods composed of such a mixture were prepared for the author in 1892. These yielded excellent results. By varying the percentage of plumbago in the mixture it was found possible to obtain a very wide range of resistance. Tables are given showing the details of the tests made in 1892 with rods containing 10, 15, 30, 40, 45, and 50 per cent. of plumbago. The results of these tests convinced the author that it was possible to prepare mixtures of plumbago with Stourbridge clay, kaolin, or fireclay, having a specific resistance 10,000 to 30,000 times that of arc-light carbons.

Rods of the above composition were fitted with metallic caps and arranged in electrical series in wooden resistance frames. These have been used since 1892 in the Electrical Engineering Laboratory of University College, London. The advantages of such resistances are that they are cheap, occupy but little space, and that they obviate the use of large and expensive plug resistance boxes.—J. B. C. K.

Alkali Chloride Solutions, Electrolysis of. Foerster. Zeits. für Elektrochem. 1899, **6**, 11.

See under VII., *page* 830.

PATENTS.

Ozonisers, Impts. in. E. Andreoli, London. Eng. Pat. 20,206, Sept. 23, 1898.

The improvements relate to ozonisers such as described in Eng. Pat. 21,707 of 1893 (this Journal, 1894, 162). The claims refer to the enlargement of the tube at the central or other parts, to act as distance pieces and for the external armature to rest against; to the use of an external armature composed of flat discs and connections therefor (said discs being unserrated on their internal circumference) between which and the dielectric, the glow of the silent discharge produces the ozone; an ozone tube in which no vacuum exists, with a metallic layer or coating on the inside of the dielectric, and acting as an internal electrode, so as to minimise resistance between the external electrode and said dielectric; the use of metal or carbon in a fine state of division, and in a thin layer or spreading, constituting in a vacuum tube the internal electrode, said electrode not being in contact with, but separate from, the metallic connection between the vacuum tube and the coil: the use of metal or carbon in a fine state of division, and in a thin layer or spreading, constituting in a vacuum tube the internal electrode, said electrode being in contact with the metallic connection between the vacuum tube and the coil.

"Vacuum tubes may be used with metal or carbon in a fine state of division, acting as the internal electrode, and which need not be in contact with the wires which connect the tube to one of the poles of the induction coil. The metal or carbon in a state of fine division, when used as the internal electrode in a vacuum tube, is in its action similar to that of the metallic particles in a 'cohera'" (coherer).—J. C. R.

Battery [*Primary*] *Solutions, Impts. in.* H. Blumenberg, State of New York, U.S.A. Eng. Pat. 21,364, Oct. 11, 1898.

The electrolyte is composed of a mixture in approximately equal proportions of a chlorate or bisulphate of an alkali, such as soda, or of an alkaline earth, dissolved in water.
—G. H. R.

Electrolytic and Kindred Apparatus, Impts. in Liquid Feed Devices for. [*Throttling Tube.*] R. Girouard, Maine, U.S.A. Eng. Pat, 10,205, May 15, 1899.

The electrolytic apparatus consists of a supply reservoir connected with a delivery vessel by means of a throttling or capillary conduit, which supports it and is vertically adjustable. In connection with the supply reservoir there is a distributing main, with risers branching from it, and connected with these by capillary conduits are delivery vessels with outlets. This invention has for its object the reduction of electrical leakage and the constant supply of liquid, and is specially applicable to operations such as those described in Eng. Pat. 8061, 1894 (this Journal, 1894, 891).
—G. H. R.

Electrodes and Electrode Connections, in Liquid Feed Devices, and in the Construction of Enclosing Vessels for Electrolytic and Kindred Apparatus; Impts. in. H. Carmichael, Massachusetts, U.S.A. Eng. Pat. 10,320, May 16, 1899.

In this process, which is an improvement on that described in Eng. Pat. 8061, 1894 (this Journal, 1894, 891), the enclosing vessel is made of a concrete composed of Portland or an analogous cement and a sand made of crushed quartz. The electrodes are contructed on the internal and external system, and each consists of a tube of porcelain or other insulating material closed at one end and open at the other. A pin of platinum passes through and is sealed in the closed end of the tube, within which it is included and from which it protrudes. A non-corrodible conductor, such as platinum, is attached to and radiates from the protruding end of the pin, while a conductor of copper is in contact with the included end of the pin, and passes out through the open end of the tube, which is filled with a viscous insulating material, such as asphalt. There is a liquid feed apparatus, consisting of a reservoir, a pipe having an axis, with rotary movement, a scoop end, a stem, and a delivery opening, and so mounted with reference to the reservoir that the rotary motion of the pipe carries the scoop end below the level of the liquid in the reservoir, the relative proportions of the scoop and stem parts of the pipe being such that the volume of contained liquid in the pipe, in and after emission from the liquid in the tank, is at least equal to the volume of contained liquid in the pipe when the pipe is at that point in its rotary motion, when the delivery opening begins to spill. The opening of the scoop end is so placed with reference to the rotary movement of the pipe that in the moment of immersion, the part of the scoop opening furthest from the axis is in angular rotative advance of that part of the scoop opening which is nearest to the axis.—G. H. R.

Galvanic [Single-Fluid] Cells, Impts. in. W. E. Case, Cayuga County, New York, U.S.A. Eng. Pat. 12,171, June 10, 1899.

In this cell the electrical energy is derived from the oxidation of carbon at normal temperatures, and the positive electrode is formed of carbon, and the negative of platinum, whilst the electrolyte is a solution of ferric chloride, which is reoxidised by passing atmospheric air through the solution as it becomes reduced to a ferrous state during the working of the cell.—G. H. R.

Galvanic [Two-Fluid] Cells, Impts. in. W. E. Case, Cayuga County, New York, U.S.A. Eng. Pat. 12,172, June 10, 1899.

In this cell the electrodes are formed of platinum, whilst the electrolyte is composed of solutions of ferrous and ferric chloride respectively, separated by a porous partition. During the working of the cell, the ferrous solution becomes oxidised, whilst the ferric solution is reduced. The latter is regenerated by bubbling atmospheric air through it, whilst the former is restored by the addition of powdered carbon, which reduces any ferric oxide formed.—G. H. R.

(*B.*)—ELECTRO-METALLURGY.

Electrical Conductivity of Solids [Incandescence Rods, Filaments, Pyrometers, &c.] at very High Temperatures. W. Nernst. Zeits. für Elektrochem. 1899, **6**, [2], 41—43.

The electrical conductivity of metals at very low temperatures is extremely great and gradually diminishes with rise of temperature. With few exceptions the opposite is the case with electrolytes. Some solids were also known to conduct electrolytically at the ordinary temperature but the author has shown that many solid electrolytes conduct the current with great ease at very high temperatures.

The first experiments showed that the conductivity of rods of pure oxides, which stand ignition in the air, certainly increased with rise of temperature but nevertheless always remained relatively small. On the other hand the electrolytic conductivity of rods made from mixtures of oxides, such as those of magnesium, silicon, and zirconium increased very rapidly and attained very high values. In several cases conductivities of over four were observed, which is considerably higher than that of the best conducting sulphuric acid, *viz.*, 0·74 at 18° C.

In order to prevent the destruction of the filaments or rods by electrolytic decomposition, alternating currents were at first employed, but at a later stage it was found that the mixed oxides could be kept incandescent by means of the direct current for hundreds of hours without suffering any ill effect.

Further experiments showed that the filaments were in reality electrolysed and that metal migrated towards the cathode and oxygen towards the anode. At the cathode the metal was immediately re-oxidised by the oxygen of the air and owing to the accumulation of this oxide at the cathode the conductivity became greater and the light emitted, less intense. The anode end on the other hand became gradually poorer in oxide, and, as this increased the conductivity of this portion, the light emitted in the neighbourhood of the anode became more intense.

It was expected that complete decomposition or destruction of the rod would soon take place, but this was found not to be the case. Decomposition does take place up to a certain stage when equilibrium sets in, and diffusion of the products exactly counterbalances the migration of the products towards the poles. In this stationary condition the only change that occurs is evolution of oxygen at the anode and absorption of oxygen at the cathode. According to this view the presence of oxygen is necessary if the incandescent filament is fed with a direct current. Experiment showed that minute quantities of oxygen or of aqueous vapour, which undergoes dissociation, were sufficient for this purpose.

By providing the incandescence rods with iridium electrodes, the author hopes to construct resistance pyrometers which will serve for the measurement of higher temperatures than any known form of pyrometer.—J. S.

Silicon, Graphitoidal; Preparation of. Frederick S. Hyde. J. Amer. Chem. Soc. 1899, **21**, 663—665.

A mixture of 4 parts of finely powdered white sand and 1 part of powdered magnesium is gently ignited in a test-tube. The lower part of the tube is heated first and gradually reaches incandescence, which then creeps up the tube. The brownish-black contents of the tube are then ground up, mixed with powdered cryolite, and placed in a crucible with a piece of aluminium in the bottom. The crucible is heated in a furnace until the aluminium melts when the mass is well stirred with an iron rod and when fumes and tongues of bluish flame are evolved, the heating is stopped. The metallic mass, together with any globules of alloy found in the black slag, is treated with warm hydrochloric acid which dissolves the aluminium and leaves the silicon in the form of black glistening spangles which are washed first with water, then with alcohol and finally dried on the filter. The yield is about 10 per cent. of the silica used. Zinc has been used in place of aluminium to alloy with the silicon, but has the following disadvantages: (1) it melts and volatilises at a low temperature (2) large quantities of zinc wool are condensed on the inside of the furnace and crucible thus interfering with the operation (3) the zinc-silicon alloy is not readily attacked by hydrochloric acid (4) the silicon is obtained in needle-shaped crystals.

On account of its high electrical resistance, the use of silicon in the form of compact rods has already been suggested for electric heating apparatus.—T. H. P.

Silver-Gold Alloys, Electrolytic Separation of. A. Dietzel. Zeits. f. Elektrochem. **6**, 81—85.

The simplest method for separating the gold and silver in these alloys is to use the alloy as anode material in a bath of silver nitrate acidified with nitric acid. The silver passes into solution, and is deposited in equivalent amount at the cathode, while the gold remains insoluble as anode sludge.

This method is less satisfactory when other metals are present in the alloy, for these, if soluble, pass into solution at the anode, and the composition of the electrolyte thus undergoes gradual change. When copper is present in the alloy there is also danger lest it should be deposited with the silver at the cathode, and this is especially the case with the poorer gold-silver alloys, which always contain considerable percentages of copper.

In order to avoid the difficulties which arise from this cause, when carrying out the Moebius or any similar process for separation of the gold and silver in the poorer alloys containing these two metals, the author recommends the reversal of the ordinary process, and the deposition of the copper by electrolysis, after separation of the silver by chemical means. This method of treating the poorer alloys of gold and silver has been in practical operation at the "Gold- und Silber-Scheide Anstalt" at Pforzheim for six years, and at present about 60 kilos. of alloy are being treated per day by this modified process.

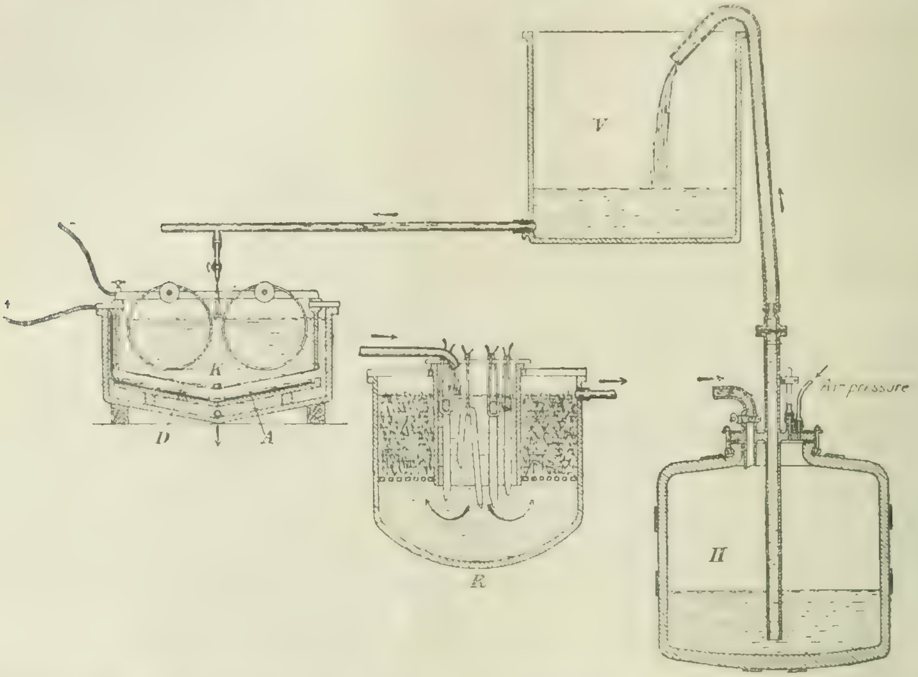
The composition of the materials received, varies between the following limits:—Gold, 5 to 7 per cent.; silver, 22 to 50 per cent.; copper, 40 to 65 per cent.; zinc, tin, lead, 5 per cent.; cadmium, iron, nickel, and platinum, traces.

The cuttings, &c., in which form the alloy comes to the Scheide-Anstalt, are melted, and the alloy is cast into anode slabs 3—5 mm. thick. A copper nitrate solution containing 2 to 5 per cent. of copper and 0·05 to 0·40 per cent. of free nitric acid is used as electrolyte. The accompanying figure shows the arrangement of the apparatus.

The cathodes are represented at K, and are formed by two rotating sheet-copper cylinders, mounted as shown, so that the driving portion of the apparatus is above the level of the electrolyte. The surface of the cylinders is slightly greased or black-leaded to promote the removal of the copper deposit, and this is stripped off as soon as any tendency towards "treeing" is noticed. The anode plates of alloy are carried in movable supports or trays at A. These can be made of ebonite or celluloid, or they may be more simply made of sheet-glass contained in wooden frames. The electric current is conducted to the anode plates resting in these trays by insulated conductors, the metallic contact between the conductor and the anode being made by some material not attacked by the electrolyte

Platinum, chromium, or carbon may be used. 1 centner of anode material occupies about 2 sq. metres on these supports, and requires about six days to work up. Between the rotating cathodes and anode trays a diaphragm of linen cloth, D, is stretched in a movable frame. This diaphragm serves to catch pieces falling off the cathode cylinders, and also to hinder the passage of the anode electrolyte towards the cathodes. The copper nitrate solution, slightly acidified, is conducted from the feed-tank, V, to the depositing vat by glass pipes, and is fed in between the two cathode cylinders. It passes downwards through the vat, and is drawn off by a pipe at the bottom below the anode trays. During its passage through the vat, it is robbed of its copper in the upper part of the cell, and is enriched with equivalent amounts of copper, silver, zinc, cadmium, nickel, and iron in the lower or anodic compartment of the cell. The solution on issuing from the cell is then passed through a series of vessels similar to R, in which the silver is displaced by copper by simple chemical action. Copper equal to about $\frac{1}{14}$th of the weight of the alloy used, has to be consumed in these, in order to effect the desired precipitation of the silver.

It is not possible to remove the last traces of silver by this method, but the amount found in the deposited copper should not exceed 0·03 per cent. when the process is working satisfactorily. After passing through a series of these precipitating vessels, the electrolyte will be neutral, and if much iron be present, it will be necessary to remove it by aëration and filtration. The liquid then flows into a reservoir, H, from which, by air-pressure, it is pumped into the feed-tank as required. In the latter it receives the addition of nitric acid, which is requisite to maintain the electrolyte in good working condition, owing to solution of other metals than copper and silver at the anode.



Of these metals—zinc, nickel, cadmium, and iron—zinc may cause much trouble if present in considerable amount in the alloy used. At the end of certain periods these impurities accumulate to such an extent that it is necessary to discard the electrolyte and start afresh with a new solution of copper nitrate.

The undissolved portion of the anode remains as a fine mud upon the anode trays, and contains, besides gold—silver, copper, lead, and tin. It is removed from the vats, and is boiled with dilute nitric acid. The residue is then dissolved in aqua regia, the insoluble chlorides are filtered off, and the gold is precipitated with ferrous chloride.

The above method of treatment has yielded satisfactory results on a practical scale of operation, and under favourable conditions, the value of the recovered copper alone covers the cost of the electrolytic and chemical operations.

—J. B. C. K.

Mercury, Electrolytic Extraction of. Ind. Électrochim. 1899, 3, 6—7.

The raw material (cinnabar) is crushed to a fine powder, and then treated with a hot solution of sodium sulphide containing caustic soda. The electrolytic vats are of iron, and may be used as cathodes; the anodes are of sheet steel. It is stated that the mercury can be readily separated from the sulphide solution by using a current density of 0·5—0·8 ampère per square decimetre and an E.M.F. of 2 volts. The electrolyte can be used again for extracting fresh ore after addition of sulphur.—A. S.

PATENTS.

Chromium by Electrolysis; Impts. relating to the Extraction of. J. F. L. Moeller, London, and E. A. G. Street, Paris. Eng. Pat. 18,743, Sept. 1, 1898.

It is proposed to obtain metallic chromium by electrolysing chromium sulphate solutions, and in particular the chrome, potash or soda alums; to employ anodes of lead, whether porous partitions are used or not, to maintain the density and other conditions of the electrolyte, degree of acidity next the cathode (cylinder of copper or brass), and the like, automatically, using an indicating rod mounted in parallel with the main cathode, and generally to render the process cyclic in character. In speaking of the liquid next the anode it is sometimes referred to as the *anolyte;* where the deposit at the cathode is of the non-metallic and mere surface character, which will not thicken, it is spoken of as *chromage*.

The first of three claims appears thus: "A process for the extraction of chromium by the electrolysis of salts having a sulphate of chromium base, the object being to utilise all the sub-products present in the anode compartment, that is to say, sulphuric acid, chromic acid, and sulphate of soda, by causing them to enter the cathode compartment integrally, that is to say, in the form of alum of chromium and of soda and of sulphate of soda, the said process consisting (*a*) in cases in which the bath is fed with alum of chromium, in causing to fall in more or less small streams into a vessel containing melted sulphur, the liquid leaving the anode compartment of the electrolyser which has been previously treated with a current of [gaseous] sulphurous acid in order to transform the chromic acid into sulphate, and mixed with bichromate of soda in such quantity that it contains one equivalent of free chromic acid, Cr_2O_6, *i.e.*, 2(CrO_3), for two equivalents of free sulphuric acid, H_2SO_4, so as to form sulphate of chromium, which, with the sulphate of soda previously formed at the expense of the bichromate, constitutes the alum intended to supply the electrolyser; this complex liquid being intended to feed the cathode compartment which continuously becomes enriched with an excess of sulphate of soda, is submitted at the same time, during working, to a circulation and to a reduction of temperature, which frees it by crystallisation from this excess of sulphate of soda, and thus enables the composition of the liquid in the cathode compartment to be kept constant. (*b.*) In cases in which the bath is supplied with sulphate of chromium, in treating the liquid leaving the anode compartment of the electrolyser with a current of sulphurous acid, then in saturating with hydrated oxide of chromium, this complex liquid being intended for feeding the cathode compartment."—J. C. R.

Metals, Extracting or Reducing, or for making Metallic Alloys by Electrolysis; Improved Apparatus for. H. Bumb, Berlin. Eng. Pat. 6297, March 23, 1899.

The first claim is for: "A continuously working apparatus for extracting or reducing metals or making metallic alloys by electrolysis, characterised by a melting pot having an outlet through which the molten metal can run off continuously; a funnel made of non-conductive material projecting downwards in the vessel and the neck of which, at its lower end, constitutes a decomposing chamber, said chamber being closed, at the top, by means of a grating which serves as a connection with one pole of a source of electric supply, and which is made of a conductive material proof against heat and chemical action, and being provided at the bottom with a circular ring, which serves as a connection with the other pole of the electric source of supply, said ring dipping into the molten metal; the grating being almost on the same level as the outlet from the melting pot and the neck of the funnel, extending downwards to such an extent as to constantly dip below the surface of the molten metal even when the electrolyte is introduced, so that the electrolyte enclosed within the decomposing chamber, and which is subjected to electrolytic decomposition, can always be accurately measured, and the gases generated during the decomposition are not allowed to act upon the melting pot, substantially as herein-before described with reference to the drawing."—J. C. R.

Silver Plating, A New or Improved Process for. R. Fiedler, Berlin. Eng. Pat. 6589, March 27, 1899.

"A new or improved process for silver plating articles of metal in a cold state in which the respective objects are cleaned, scoured, and silver plated at the same time, by being rubbed with a cloth or the like saturated with a silver solution capable of dissolving or absorbing dirt and grease."

"A form of the silver-plating process just described, in which the silver-depositing solution consists of about 15 parts of fused chloride of silver, about 150 parts of ammonia, about 30 parts of potassium tartrate, about 300 parts of whitening, about 60 parts of potassium cyanide, and about 0·5 part of zinc powder mixed together and heated."

"The so obtained liquid in colour and consistency resembles milk. For use, it is poured on a cloth or the like with which the objects to be silver-plated are then smartly rubbed."

"The principal new technical feature and in practice exceedingly important advantage, is that instead of several separate prepared bath solutions and the like which can be made only by an experienced professional man, a simple manipulation only is required, whereby the desired result is immediately obtained."—J. C. R.

Aluminium, Impts. in the Art of Plating and Colouring [***Electrolytically***]. M. B. Ryan, Catford, Kent. Eng. Pat. 12,390, June 14, 1899.

"The method of treating aluminium and its alloys preparatory to the electro-deposition of the final coating thereon, consisting of the alternate immersion in alkaline and acid solutions as follows:—Whale oil soap, muriatic acid (15° B.), cyanide of potassium (20° B.), phosphoric acid (50° B.), and into a solution containing a muriatic salt (bichloride of mercury, &c.), whereby the surface of the aluminium has fixed thereon an amalgam of mercury before being immersed in an electrically operated solution." The specification gives full particulars for preparing the dipping and plating solutions. "After passing through the striking solutions, the metal may be rolled, drawn, or handled in any similar way, without causing any separation of the deposited metal film from the surface thereof."—J. C. R.

XII.—FATS, OILS, AND SOAP.

Halphen Reaction, The. P. Soltsien. Zeits. öffentl. Chem. **5**, 135. Chem. Centr. 1899, **1**, [26], 1297.

See under XXIII., *page* 865.

Edible Cotton-Seed Oil. Chem. and Druggist, Aug. 26, 1899, 370.

See under XVIII., A., *page* 851.

PATENTS.

Oils, Edible and other; Improved Mode of Treating. J. N. Harris, South Norwood, and H. S. Headington, London. Eng. Pat. 19,085, Sept. 7, 1898.

In this process, for each stage of which separate claim is made, the oil is heated at 110°–130° F. and mechanically mixed with a purifying substance such as animal charcoal, say in the proportion of 1 cwt. to each ton of oil. The charcoal and impurities are then allowed to separate, the liquid being meanwhile kept at about 120° F.

The oil thus purified and decolorised is aërated for about 30 minutes at a temperature not exceeding 110° F. in the presence of "methylated alcohol" containing 1 per cent. of gum myrrh and half a per cent. of gum benzoin, after which it is allowed to stand for some time at about 100° F. It is stated that oil thus treated acquires a pleasant nutty flavour which increases its value for medicinal purposes.

In the treatment of rancid oils by this method, an alkaline substance, such as prepared chalk, is added with the animal charcoal in the purifying process with the object of neutralising the free fatty acids.—C. A. M.

Wool, Impts. in Extracting Grease from, and in Apparatus therefor. W. Erben, Philadelphia, U.S.A. Eng. Pat. 11,772, June 6, 1899.

See under V., *page* 829.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

Lead Chromates, [***Pigments***], *Manufacture of.* T. Goebel. Chem. Zeit. 1899, **23**, [51], 543. (See also this Journal, 1891, 709, and 1892, 357.)

With regard to the composition of "Lemon Yellow," the author does not take it to be the chemical compound $PbCrO_4.PbSO_4$, since a very much smaller quantity of $PbSO_4$ than this suffices to prevent a "Chrome Yellow" from assuming the obnoxious dull straw shade. For the production of Chrome Red (better known by the name of Chinese or Persian Red), Gentele recommends the treatment of white lead with caustic soda, to wash out the hydroxide of lead thus formed, and then to boil with chromate of potash. The author uses "White lead" in a fine state of division, made by grinding it with water in a paint mill, and after sieving it through a very fine sieve, he acts upon it for

1—2 hours in the presence of steam with a mixture of sodium chromate and caustic soda. When a sample shows no longer specks of white lead, the colour is washed free from the soluble chromate, and may then be treated carefully with a small quantity of sulphuric acid, which improves the brilliancy.

From sulphate of lead ("lead bottoms,") a red can be made equally brilliant and cheaper, in the following manner. The sulphate is treated for some days in a tank provided with a mechanical agitator, with sodium carbonate, and some caustic soda. The carbonate is decanted and treated as already described.—S. K.

PATENT.

Sesquioxide of Chromium, Impts. in the Manufacture of ***Direct from Chrome Ore.*** R. W. E. MacIvor and T. F. Spencer, both of London. Eng. Pat. 20,681, Sept. 30, 1898.

See under X., *page* 837.

(*B.*)—RESINS, VARNISHES.

Copal Varnish for Negatives, The Use of Epichlorhydrin for the Manufacture of. E. Valenta. Phot. Corr. 1899, **36**, 333. (From Chem. Zeit. Rep. 1899, **23**, 184.)

The author has prepared different varnishes, using dichlorhydrin and epichlorhydrin as solvents (see Fleming, Eng. Pat., this Journal, 1896, 364). The former yields yellowish or even brownish solutions, particularly when heat is employed, whereas epichlorhydrin, as a rule, produces a light-coloured varnish. The following is a good formula: 20 grms. of Manila gum are digested on the water-bath with 70 grms. of epichlorhydrin. When dissolved, 100 c.c. of absolute alcohol are added. For thinning, a mixture of one part of epichlorhydrin, with 5 parts of alcohol may be used. This varnish runs well, dries quickly, and with gloss, and is more resistant than the ordinary shellac varnishes. The dichlorhydrin might be advantageously employed in the varnish manufacture, for dissolving bleached shellac.—S. K.

(*C.*)—INDIA-RUBBER, &c.

Caoutchouc, Regenerating. Max Zingler. Rev. Prod. Chim. **2**, [10], 148.

The oxidised or "perished" caoutchouc, is washed, rolled out into thin sheets, and immersed for several days in one of the following solutions, the proportions given being per 100 parts of caoutchouc:—

(1.) Water, 300—400 parts; tartar emetic, 2·5 parts; tannic acid, about 7·5 parts; sodium sulphite, 2·5 parts. The tannic acid may be replaced by catechu, bark extract, &c., in suitable proportions.

(2.) The same solution, except that the tartar emetic is replaced by about 5 parts of calcium sulphite or other metallic sulphites.

(3.) Solution No. 1, *plus* 2·5 parts of calcium (or other) sulphite.

On removal from the bath, the caoutchouc is dried in a current of air or by means of a hydro-extractor, and will be found to have become non-absorbent towards moisture, its solidity and resistance to extension being also improved by the treatment.—C. S.

India Rubber Substitutes, Three Natural. D. Hooper. (Brit. Pharm. Conf.) Pharm. Journ. **63**, (1518), 94—96.

Banian rubber, from *Ficus bengalensis*.—The rubber was dirty-white in appearance, had a sourish odour, and dissolved, without previous swelling, in ether, in chloroform, and in carbon bisulphide. An appreciable amount was also soluble in boiling alcohol. It contained 62·25 per cent. of resin, and only 19·82 per cent. of caoutchouc, which would render it unsuitable for use as a rubber substitute. It is suspected that the product is used for admixture with pure Assam rubber derived from the nearly allied *Ficus elastica*.

Madar rubber, from *Calotropis gigantea* and *C. procera*, contained but 16·9 per cent. of caoutchouc.

Excæcaria rubber, derived from *E. agallocha*, known in the Sunderbans as "Gengwa," occurs as a milky latex, possessing marked irritant properties when applied to the skin, and hardening when exposed to the air. Although it contained 28·85 per cent. of fluavil, this was not accompanied by any caoutchouc. The irritant principle was extracted with the fluavil by solution in alcohol; the juice contained a considerable quantity of albuminoids. Apparently none of these products are available as rubber substitutes.—J. O. B.

PATENT.

Artificial Rubber, or Rubber Substitutes, Impts. in or relating to. J. Deborde, Berlin. Eng. Pat. 20,044, Sept. 21, 1898.

In order to increase the elasticity of an insoluble mass of gelatin and glycerin which has, or has not, been mechanically beaten into a frothy condition as described in Eng. Pat. 8905, 1897 (this Journal, 1897, 816), the substance is allowed to set, and is then broken up or pulverised so as to form a kind of powder.

Eng. Pat. 18,950, 1898, is also referred to.—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Hemlock and Hemlock Extract [Tanning]. Leather Trades Rev. 1899, **32**, 542, 687.

The hemlock spruce is chiefly valuable on account of its bark, which is rich in a most valuable form of tannin. It is not only a rapid tanning agent, but is also claimed as a weight-giving material. Tanners allege that 1 lb. of hemlock extract will go as far as 1½ lb. of oakwood or chestnut extract (*i.e.*, that it will do more work and will produce 1 to 2 lb. more leather per hide). It has, however, on the other hand, an objectionable red colour, and possesses a considerable quantity of resinous matter, which is liable to cause trouble in the tanning process, and is difficult either of solution or dilution. This latter difficulty, however, has been largely surmounted by a new process of clarification, and the reddish colour may be counteracted by using it in conjunction with such light-coloured materials as valonia, myrobalans, oak bark, &c. It is further claimed for it that it gives a close fibre, the cut of the leather being clean and glistening, besides being water resistant. In America, the extract is used on the goods after they have been "plumped" with sulphuric acid, but in England the goods are "plumped" in old tan liquors, after which they are treated for about 6—8 weeks by agitation in "handlers," and are then given a fortnight in "dusters" containing hemlock extract, this hemlock liquor being allowed to pass through the handlers, and so on out of the tan yard. The goods are then placed in layers, and half a cask of hemlock is added to each layer to bring the liquor up to the required strength. If the hemlock extract be used in this manner, and the goods dusted down with myrobalans and valonia, or either of the two alone, the leather then dries to a bright colour, is firm, and well weighted, and exhibits none of the objectionable characteristics of "hemlock leather," either as regards colour or resinous patches.—J. G. P.

Hides for Army and Navy Uppers, The Tanning of. Leather Trades Rev. 1899, **32**, 612, 688.

To avoid faults due to improper bateing, which faults always show up more clearly in the tanned or finished goods, it is necessary to carry out the wet work with extreme care, filtering the bate liquor so as to escape "bate burns," to avoid keeping the hides too long in the bate, and thus escape what is known as "low bateing," "flesh slipping," or "pricking." When stains appear on the flanks, the goods should be taken out and put into a bath containing about 5 lb. of borax per pit. If these precautions be carried out the faults mentioned should not appear.

The tanning materials mostly used for army leathers consist of gambier, oak bark, valonia, myrobalans, or sumach and mimosa bark, the quantities of each varying in nearly every tan yard; the materials are leached in the ordinary manner. The hides, first of all, go into a partly spent liquor which contains very little tannin. It is usually done in a "paddle," to which about five buckets of strong gambier are added to a pack of, say, 60 army hides. They are "run" in this for about an hour, and when grained, they then go into the "shifts," and are gradually worked forward, being frequently handled in the early stages. The quantity of gambier used should be at least 1 lb. per hide for the green goods. When the hides are sufficiently advanced to justify the drawing of new liquors from the leaches, double the quantity of gambier should be added. After the hides have had five new liquors, they are then drained and passed over to the layers, and are dusted down with mimosa bark and valonia in finely ground condition. They are handled up and down in this for six days, well drained, and are then treated with sumach. The sumach treatment is carried out in a drum, 20 hides being operated at a time, with the addition of six buckets of strong sumach liquor. In this liquor the hides are run for about 20 minutes. They are then rinsed in warm water, thrown over a "horse" to drain for two or three days, when they are "oiled off" with warm cod oil. The drying must be carefully performed. After drying, the goods are taken and weighed.

All hides intended for army or navy purposes are "rounded," the offal being worked up for coloured boot uppers. When rounded, the butts are termed "army butts." The butts are now damped back, and left in pile to "sammy." They are cut down the back and split in the band-knife machine; the flesh-split is dried and used for linings for boots. A second split is then taken off with the "Union" machine, this machine cutting finer and more evenly than the band-knife.

The grains are now termed "Army grains," or if very thin, "Navy grains." These are taken and again treated with sumach, and also oiled, dried very carefully and gradually, and placed in pairs previous to entering the warehouse. The "fleshes" (*i.e.*, split hides) from the "Union" machine are curried and dressed like kip butts, and are called "waxed fleshes," being used for cheap boots, &c.—J. G. P.

Leather, Satin; Manufacture of. Leather Trades Rev. **32**, 766.

East Indian shoulders are generally used, although hides, hide bellies, shoulders, and kips are also dressed for satin leather. There are different methods employed in finishing this class of leather, but all must tend to produce that fine silky feeling characteristic of satin.

The shoulders, presuming them to be East Indian, are first "soaked" to a suitable condition for shaving, and then thrown into a drum and run for a short time to break up the "flesh." A small quantity of cod oil facilitates the shaving considerably. The shoulders are next "shaved level," and the cheeks taken well down. If thick, they may be first "split" with a band-knife machine, and then levelled off with the shaving knife. They are now treated with sumach and well scoured. They must be quite free from "stretch," otherwise it is impossible to "buff" the goods properly later on. They are now hung up until ready for stuffing, which may be performed with English dégras, brown grease, stearin, and wax. On coming from the stuffing drum they are "canked on the flesh," "stoned on the grain," partially dried, and then re-set, redried, and laid in pile for a few days for buffing. It is the buffing which imparts the soft, silky feeling, and renders the material easier to black and less liable to crack. It certainly makes leather less waterproof, but this objection has been practically overcome by the use of an additional amount of grease. A thin soap solution is brushed over the grain side previous to buffing. After buffing, the goods are blacked by brushing in a logwood liquor, to which has been added a little ammonia. When this is thoroughly dry, they are brushed over with an ink; they should then be lightly greased on the blackened side with dubbin, and allowed to lie over night in the grease. The material is then hung up to dry, and is operated on upon the flesh side with a thin "sleeker" and "glass." When dry, the hides are ready for whitening. They are next trimmed and softened, and are then given a good coating of melted tallow, brushed upon the black or grain side, and allowed to lie for seven days before the tallow is removed. After rubbing over with a pad, they are "finished." A bright finish can be made from logwood liquor, potassium bichromate, potassium ferrocyanide, and blood. When dry, they are rubbed over with an oily piece of flannel, and "glassed" for the purpose of contributing gloss. The leather should not be stacked in too large piles in the warehouse, otherwise it may stick together and the finish may be injured.—J. G. P.

PATENTS.

Dyeing or Printing on Leather, An Improved Process for. E. Peltzer, P. Peltzer, and G. Peltzer, Renoupré-Verviers, Belgium. Eng. Pat. 6515, March 25, 1899.

See under VI., *page* 830.

Hides and Skins of Animals and the like, Process of Unhairing. G. D. Burton, Boston, Mass., U.S.A. Eng. Pat. 14,221, June 27, 1898.

A process by which hides and skins are unhaired by subjecting them "to the action of" "a solution of quicklime and red sulphide of arsenic, and an electric current passed through said solution, the current being of sufficient volume to raise the hair and permit circulation through it." Good results are said to be obtained by using 10 lb. of quicklime, 1 lb. of red sulphide of arsenic to 70 galls. of water, and a current of from 1 to 20 volts and from 30 to 75 ampères according to the size of the tank, the density of the liquor, and the number of skins to be unhaired.—J. G. P.

Hides and Skins of Animals and the like, Process of Tanning and Colouring. G. D. Burton, Boston, Mass., U.S.A. Eng. Pat. 14,220, June 27, 1898.

This invention consists in passing a current of electricity through a tanning solution containing hides or skins, then adding colouring matter to the tanning solution and again passing a current of electricity through the same.—J. G. P.

Tanning Process, An Improved. Fritz Schedlinsky, Luxembourg, Germany. Eng. Pat. 8590, April 25, 1899.

The process consists "in tanning, circulating, or passing the tanning liquor through a number of vats so that the hides or skins suspended therein successively absorb the tannin."—J. G. P.

Leather, Enamelled, Impts. in; and in Enamels for producing the same. G. S. Wolff, Philadelphia, U.S.A. Eng. Pat. 13,357, June 27, 1899.

The ordinary compositions, made chiefly of boiled oil, that are used as a first coat in the preparation of "patent" leather will not adhere securely unless the natural grain surface of the leather, which is smooth, has been removed by a knife, so as to present a roughened foundation on which the material can be laid. Moreover, if the oil be boiled too much, it tends to become opaque and to mask the grain of the leather, but if it be too weak, it soaks in. According to the present invention a first coat of improved composition is applied directly to the grain surface, a polishing varnish being employed afterwards. The first is prepared by boiling linseed oil for three or four hours with 0·5 or 1 per cent. of Prussian blue, diluting the partially cooled product with 50 per cent. of "benzine." 115 parts of the diluted oil are mixed with 45 parts of a solution of camphor in turpentine (1 : 2), 20 parts of a filtered solution of "chicle" in turpentine (1 : 1 by volume), 20 parts of a solution of india-rubber in turpentine (1 : 4 by volume), and any desired pigment; and the whole is ground on a mill. The second varnish is prepared by boiling linseed oil for $1\frac{1}{2}$ hours with 8 per cent. of Prussian blue (for black leather), or with 10 per cent. of manganese borate (for other colours), diluting as before with 50 per cent. of "benzine." 70 parts of the oil are next mixed with 30 parts of the above camphor solution, strained, and diluted with more benzine, till it flows freely. The leather, already finished as glazed, ironed, or dull-surface leather, is damped, stretched, dried, "soft-boarded," and again dried and stretched. The first varnish is then painted on the grain side, dried at 82° C. and exposed to air till quite hard. The second varnish is next applied and treated as before, when the product is ready for sale.—F. H. L.

Gelatin, Impts. in the Manufacture of Spangles and other Articles from. A. Zimmermann, London. From the "Chemische Fabrik auf Actien vorm. E. Schering," Berlin. Eng. Pat. 19,325, Sept. 10, 1898.

Instead of stamping spangles, "paillettes," and similar coloured or uncoloured articles out of sheets of gelatin which have previously been rendered insoluble by means of formaldehyde, the said objects are cut from sheets of soluble gelatin, and the hardening process is carried out afterwards with the aid of formaldehyde vapour. By this improvement no insoluble gelatin waste is produced.
—F. H. L.

Size-Powder, A Process for Manufacturing. L. Beeck. Crefeld, Germany. Eng. Pat. 5822, March 17, 1899.

Ordinary decorators' size, consisting of soap, alum, and size, has to be prepared by solution and boiling just before it is required for use; to avoid the inconvenience of this operation, the present specification describes means for "pulverising the materials with a view to simply dissolving them on the spot." Size is dissolved by soaking and boiling in water, and to the solution is added 150 or 180 per cent. (calculated on the dry glue) of soda ash, alum, or any other salt which "takes up the water of crystallisation contained in the size and brings about a complete solidification of the mass, so that it can easily be pulverised." The necessary proportions of soap and alum are mixed with the product, and the whole is ready for employment.—F. H. L.

XV.—MANURES, Etc.

Ammonium Sulphate, Manurial Value of. Prize Essay by J. Muir. J. Gas Lighting, 1899, **74**, 163—168, 223—227, 287—292, and 359—364.

The author's observations with regard to the use of ammonium sulphate in agriculture may be given briefly as follows:—

Sulphate of ammonia is a nitrogenous manure only, and must therefore be used in combination with phosphates, and, in most cases, potash also. Both nitric and ammoniacal nitrogen are of direct use to the plant, but the latter almost always undergoes nitrification before use. Ammoniacal manures generally fail to give their maximum result unless potash be liberally supplied by soil or manure. Sulphate of ammonia is most effective in wet climates and seasons. A small dressing of sulphate of ammonia mixed with dry ashes, sand, &c., for convenience of sowing, or with other manures, except those containing lime or carbonate of lime, or which are damp, may be applied to autumn sown crops in autumn, but most of it should be put on in spring. For all other crops, it should be used at, or a little before, the time of sowing the seed; if applied late in the growth of the crop, it may cause too great rankness. It may be applied longer before sowing on heavy land than on light; it is less suitable for very calcareous soils than for either sandy or clay soils, and still less so for soils deficient in lime. Too large a dressing causes injury from over-rankness of growth and late maturity, especially if mineral plant food be deficient in the soil.

On wheat, sulphate of ammonia (about 1 cwt. per acre) increases the quantity of produce and improves its quality; on barley (¾—1 cwt. per acre), it gives a large increase, and on the average, a better malting product than other nitrogenous manures; on oats (about 1 cwt. per acre), a larger increase of grain than with nitrate of soda, and of straw also, if potash be plentifully supplied; on mangels (1—2 cwt. per acre), it is probably superior, when farmyard manure is used, to nitrate of soda, but without farmyard manure, it has rather less effect; on turnips (about 1 cwt. per acre), it gives, compared to nitrate, as large or larger crops, which apparently keep better; on potatoes (1—2 cwt. per acre), it almost always gives a larger increase than nitrate, and is also less favourable to the development of disease; on beans and on clover, no profitable result is obtained with sulphate; on grass-land (1—1½ cwt. per acre), it produces a yield in weight about equal to, or slightly less than, nitrate of soda, and it specially encourages the grasses at the expense of the clovers, and the produce seems to be more palatable to stock than that obtained with nitrate of soda, and to have a high feeding value.

Note.—All the comparisons between sulphate of ammonia and nitrate of soda given above, are between equal quantities of nitrogen in the two forms, or between a little over ¾ cwt. of sulphate to 1 cwt. of nitrate.—A. S.

Perchlorate in Chile Saltpetre, and its Injurious Effect on Cereals and Sugar-Beet. A. Zaharia. Bull. Soc. Sciences Bucarest. 1898. (See this Journal, 1899, 593.)

The examination of 206 samples of nitrate of soda at Halle showed that one sample contained, of sodium perchlorate, 5—6 per cent.; another sample, 3—4 per cent.; three, 2—3 per cent.; eleven, 1·5—2 per cent.; whilst thirty-nine samples contained 1—1·5 per cent. of perchlorate, the rest (151) containing less than 1 per cent.

Solutions containing 0·05—0·1 per cent. of perchlorate were found to have no effect at all on the germination of sugar-beet, rye and wheat, and practically no effect on barley, whilst a slight effect was observed in the case of oats. Even 1 per cent. solutions had very little effect on the germination of wheat.

As regards the influence of perchlorate on the development of seedlings, oats were most affected, then rye, wheat, and, least of all, barley. A 0·001 per cent. solution had no effect on barley and wheat, but had a distinct effect on oats and rye.

The results of experiments with oats in different soils showed that with nitrate of soda containing 1 per cent. of perchlorate, the decrease of grain and straw amounted to 4 per cent. With 2 per cent. of perchlorate the decrease in grain may be as much as 25 per cent., whilst the effect on straw-production is less marked.

Sugar-beet is much less affected by perchlorate than oats, and the effect may be only temporary. Even nitrate of soda containing 6 per cent. of perchlorate, will not destroy a crop of sugar-beet, although it will diminish the yield of roots. Nitrate containing 2 per cent. of perchlorate is not injurious; and when only 1 per cent. of perchlorate is present, it is even beneficial, giving an increased percentage of sugar, and a somewhat higher purity coefficient.—N. H. J. M.

Nitragin, Use of, in Agriculture. F. T. Shutt. Annual Report on Experimental Farms (Canada), for the Year 1898, 137—142.

Experiments were first carried out in 1897, in order to ascertain the effect of the use of nitragin, by inoculation of the soil or seed, in inducing a more vigorous growth of the legumes. A distinct increase in the amount of nitrogen was observed in the crop in several of the inoculated series of plants.

Further experiments of a similar character have been made during the past season, and the results obtained, confirm, on the whole, those of 1897, and furnish further evidence establishing the usefulness of nitragin in fostering the growth of leguminous plants (see also this Journal, 1896, 767; 1897, 687; and 1899, 381).—A. S.

PATENT.

Manures, Artificial; Impts. in and relating to the Manufacture of. A. Wenck, Magdeburg, Germany. Eng. Pat. 4714, Mar. 3, 1899.

The inventor manufactures manure from waste products, such as town sewage or other waste products containing nitrogen, by evaporating such materials to dryness, and mixing the powdered residue with a small proportion of some alkali and with an alkaline powder highly charged with spores of nitrifying bacteria, which become active when strewn on the ground and exposed to sunlight. By these means the nitrogen present becomes converted into nitrates and nitrites, and consequently into the most assimilable form of nitrogen. The powder containing the ferment is made by inoculating some of the waste product with a very active culture of nitrifying bacteria and evaporating the germinated solution to dryness at a low temperature.—G. H. B.

XVI.—SUGAR, STARCH, GUM, Etc.

Cane Sugar, Resuscitation of, in the West Indies through Central Factories. W. Douglas. West Indian Bulletin, 1899, **1**, [1], 43—52. Contributed to the First Agricultural Conference, Barbados.

Apart from possible improvements in quality and yield of cane, there is no doubt that the only ready and rational way of resuscitating the sugar industry in the West Indies lies in the abandonment of the old wasteful system of individual manufacture, and in bringing the manufacture thoroughly up to date by introducing the latest improved machinery and scientific control. This can only be done by the establishment on a sufficiently large scale of central factories at suitable points in the sugar-growing areas, capable of producing 18,000 to 20,000 tons of sugar per season. The author gives tables showing the relative efficiencies of various methods of working, in terms of 100 parts of saccharose in the canes, which may be summarised as follows:—

System.	Saccharose in Juice extracted.	Saccharose in Megasse.	Saccharose in Sugars produced.	Saccharose in Molasses.	Loss of Saccharose in Manufacture.
1. Barbados, average single crushing and Muscovado process.	70·40	29·60	47·70	10·50	10·20
2. Dry double crushing, best mills, steam clarification, filterpresses, multiple effect evaporation, boiling *in vacuo*, &c. 1st and 2nd sugars made.	85·00	15·00	69·96	10·11	3·91
3. Double crushing with maceration, same manufacture as (2), but low sugars returned into process, total output being 96° crystals.	88·00	12·00	72·16	10·21	4·58
4. Triple crushing with maceration, manufacture same as (2 & 3), selected low products returned into process, methodical boiling, and improved treatment of massecuite.	90·00	10·00	76·41	9·36	3·15
5. Same process as (4) but with best triple mills, Hawaii. Three refining sugars made.	92·46	7·54	83·13	4·96	3·28
6. Beets, Germany. Diffusion, carbonation, &c.	96·67	3·33	83·05	8·81	4·81

There would be no difficulty in a large, well-equipped factory in obtaining at least 80 per cent. of the saccharose as 96° crystals. The conditions of erection of such central factories would depend on general location as regards water, labour, &c., and easy transport of freshly cut canes direct from the fields by light railways. To avoid friction and ensure success, it would be most desirable and almost essential that the planters should have a pecuniary interest in the factory, and after receiving a minimum price for canes, should share the profits of manufacture on the co-operative system.—J. F. B.

Beetroot Juice and Diffusion Juice, Relative Purity of. Weisberg. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 963—967.

It is generally found that the diffusion juice gains, by the process, about 2 per cent. in 'purity' as compared with the 'purity' of the juice expressed from the fresh pulp, and on examining the results of the mutual control of the Russo-Polish sugar works, an increase of from 2 to 3 per cent., and often even more, is found. From the relatively lower purity in the diffusion juice obtained towards the end of November 1896, as compared with that of other years, the author was led to examine the question. During pressure of work on the diffusion batteries, it was necessary to carry out the diffusion at a higher temperature than usual in order to attain a sufficient degree of exhaustion of the pulp, and the average result on the three batteries showed an increase of only 1·64 per cent. This result suggested laboratory experiments as to the effect of temperature and the water used on the purity of diffusion juice. The tests made were not sufficiently numerous to allow of general averages being calculated, but it was found that at 82° the purity was less than at 62° C., and less with ordinary water than with distilled water.

—L. J. de W.

Diffusion Juice, Obtaining Dense. G. Lévêque-Hérault. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 968—970.

Owing to an insufficiency of water and an inefficient triple effect, the author was under the necessity, during the season of 1898–9, of extracting the diffusion juice at a maximum density, the loss of sugar in the exhausted pulp and sweet water being at the same time maintained within acceptable limits.

The battery consisted of 14 diffusers each of which has a working capacity of 27 hectolitres. Compressed air could not be used. The quantity of water at disposal allowed of only 70 diffusers per shift of 12 hours being worked. With the help of skilled battery hands, 58 kilos of pulp per hectolitre of working capacity were charged into the diffusers, instead of the usual 54, so that this represented, in the 77 days of manufacture, a gain of five days' work. It was now only necessary to reduce the quantity of juice drawn off to a minimum.

The beetroots worked, varied from 14 to 15 per cent. of sugar in richness. The average juice drawn off (at 25° to 28° C.) was 17 hectolitres per diffuser, or 108·12 litres (at 15° C.) per 100 kilos. of beetroots, and the density varied from 5·5 to 6·1 at 15° C. Under these conditions, in spite of the annoyance caused by beetroots run to seed, cases of which were very numerous here this year, the loss of sugar was limited to 0·36 per cent. lost in the pulp and 0·10 in the sweet water, both calculated on the beetroots. The temperature was maintained at 72° to 75° C. The purity of the diffusion juice varied between 89 and 85. The working up of these dense juices, contrary to the opinion of many manufacturers, gave no trouble. The quantity of lime used, had, of course, to be increased with the increased density of the juice. 1·8 to 2·2 kilos. of lime and 0·1 kilo. of baryta were used per hectolitre of juice. The juice drawn into the triple effect was of a density from 4·8 to 5·3 which, no doubt, greatly facilitated evaporation. In conclusion, it appears possible by strict attention to the preparation of the fresh pulp, to obtain dense juice and a normal exhaustion.—L. J. de W.

Beetroot Juice, Raw; Reheating, before Liming. G. Lévêque-Hérault. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 970—971.

The best temperature of the juice for liming is from 45° to 50° C. At temperatures above this, the filtered carbonated juice is dark in colour and low in purity owing to the presence of lime salts, and the scums contain a considerable amount of sugar as insoluble sucrate.

At a lower temperature, lime has a slower action and carbonation takes longer. Moreover, the reheating of the carbonated juice occupies more time and consumes too much steam.—L. J. de W.

Diffusion [Sugar]. N. Rydlewski. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 982—983. [From Deutsche Zuckerind. 1898, 721.]

The author finds that a diffuser of 29 hectolitres capacity gave 100 per cent. of exhausted pulp on the fresh pulp introduced into the battery, as an average of four seasons, a diffuser of 46 hectolitres capacity gave 98·1 to 99·7 per cent., and one of 65 hectolitres, 93·6 to 97·8 per cent.

These results are not in accord with those known hitherto, particularly those of Pellet, but may be expected to vary from one works to another according to the arrangement of the battery and the manner of working. It thus appears that the loss of pulp is greater, and the dry solids increase with the increased capacity of the diffusers.

Samples taken by means of baskets from the top, middle, and bottom of a diffuser showed no certain difference as regards exhaustion. Dewalda, on the other hand, found the worst exhaustion in the pulp at the upper part, and Kohler at the lower part, the diffusers discharging below.

An average sample of the juice can only be obtained by taking portions during the whole time the juice is running and after defecation.—L. J. de W.

Sugar Solutions, Reduction in the Polarisation Value during Heating and Evaporation of. K. Andrlik, St. Berounsky and H. Hranicka. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 984.

After a large number of experiments with beetroot juice and solutions of saccharose in glass and copper vessels, the authors draw the following conclusions :—

When juices are heated without pressure, there are no sensible losses, provided that the heating is not too prolonged, and that the juices are alkaline. The figures showing the losses, agree with those obtained by Herzfeld.

Weak juices apparently undergo a more profound decomposition on heating, than syrups.

The evaporation of juices in a vacuum has no perceptible influence on the reduction of polarisation unless the concentration has been pushed so far that all the water is driven off, and the heating bath has been maintained at a relatively high temperature. This might occur in practice in case of an excessive desiccation of the massecuite.

Heating the juice to higher temperatures and pressures, occasions a considerable decomposition of saccharose, and the losses amount to three times the values obtained by Herzfeld on heating solutions of refined sugar. A temperature of 115° to 117° C., even, is very injurious in this respect.—L. J. de W.

Raffinose in the Fermentation of Molasses, Behaviour of. K. Andrlik. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 989—991.

With high fermentation yeast the raffinose contained in molasses behaves generally in the same way as raffinose fermenting alone in presence of saccharose—that is, only one third of the sugar (the fructose) ferments. After 72 hours of fermentation, 100 parts of raffinose yield about 13 of alcohol.

After fermenting for 72 hours, there is found in the residue of molasses as much reducing substance—which must be considered as melibiose, not fermentable by high fermentation yeast—as the molasses used contained of raffinose.

The saccharose contained in the molasses exercises no retarding action on the fermentation of raffinose.

Molasses containing raffinose, furnished on fermentation less alcohol than those which the sugars therein contained—saccharose and raffinose—should have yielded, according to analysis by the inversion method (Herzfeld's formula). The mean result was 89 per cent. of alcohol. The author explains the discordant results by the fact that the yeasts employed in the distillery are accompanied by the lactic ferment which produces secondary reactions, lowering the yield of alcohol, and, on the other hand, by the imperfection of the methods hitherto used for the estimation of saccharose and raffinose in molasses in the presence of a great number of optically active substances.

After a fermentation of 72 hours with distillery yeast, the mucic acid found in molasses, by Creydt's method, was 92·9 per cent. of that obtained from the same molasses before fermentation.

Low fermentation yeast cannot fully ferment molasses in 72 hours; but when it is allowed to act for 144 hours, the whole of the sugar (saccharose and raffinose) undergoes fermentation. The yield of alcohol reached 97·9 per cent. of the theoretical quantity on the sugars indicated by the inversion method.

By employing a mixture of high and low fermentation yeasts, there was obtained in 72 hours a better fermentation and a better yield of alcohol than when these yeasts were used separately, *viz.*, on the average, 94·4 per cent. of the quantity which should have been obtained with the saccharose and raffinose as found by analysis. The raffinose has therefore taken a greater part in the fermentation than when distillery yeast was exclusively employed.

After a preliminary treatment with a small quantity of sulphuric acid, molasses containing raffinose ferments better with distillery yeast. The necessity of experimenting with pure cultures of different species of yeast, is pointed out.
—L. J. de W.

Carob Seeds, The Albumin of. E. Bourquelot and H. Hérissey. Comptes Rend. **129**, [4], 228—231.

The albuminous portion of carob seeds is easily separated from the rest of the seeds. Effront found that about four-fifths of it consists of a mucilaginous carbohydrate which he termed *caroubin*, and which on hydrolysis gave him a new sugar, which, however, he was unable to isolate, but which he called *caroubinose*. Marlière considered this sugar as a mixture of dextrose, levulose, and galactose; he thought he had proved the absence of mannose, but van Ekenstein actually isolated mannose from the hydrolysed substance.

The authors have isolated, by processes the details of which are given in the paper, both mannose and galactose from the products of this hydrolysis, and have identified them. From the quantities obtained they conclude that nothing else can be present in the hydrolysed portion (about seven-eighths of the whole) of the original carbohydrate.—J. T. D.

Molasses, Exact Determination of the Ash of. V. Zamaron. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 967.

See under XXIII., *page* 867.

PATENT.

Raw Sugar, Refining; Improved Method of. W. P. Thompson. From H. A. J. Manoury, Paris. Eng. Pat. 19,961, Sept. 20, 1898.

The improved process claimed, is for obtaining "first sugar" and molasses only, suppressing the lower grade products or "bastard" sugars. In working with white raw sugars, the green refinery syrup is boiled to grain of the desired size, and the boiling is then continued with the whole of the rich drainings of a previous boiling, and completed with a given quantity of the poor drainings also from the previous boiling, so as to lower the purity of the mother-liquors of the massecuite to a minimum. In working brown sugars, the green syrup is first boiled to grain, and refinery syrup is then boiled with it before going on with the rich and poor drainings. In this way there is a residue of poor drainings which is not used in the boiling as above, and which still contains too much sugar to be classed as molasses. In order to work up these drainings, a portion of them is treated with baryta or strontia, and after separating the sucrate produced, the mother-liquor is mixed with the remainder of the poor drainings, thereby reducing their purity to the standard of molasses.

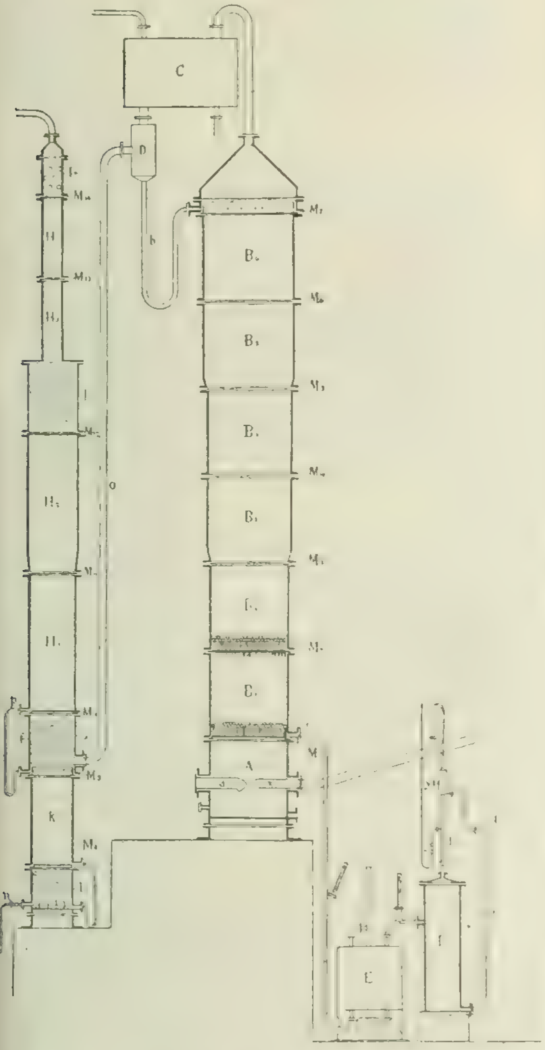
The use of sucrate of baryta or strontia for purifying 'casting' syrups, by separating the sugar from the compound by means of sulphurous or other acid, or by magnesium sulphate or like salts, is also claimed.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Spirit of Wine direct from the Wash or Crude Spirit by the Continuous System, Novel Process for Obtaining. Zeits. für Spiritusind. 1899, **22**, [29], 257—258.

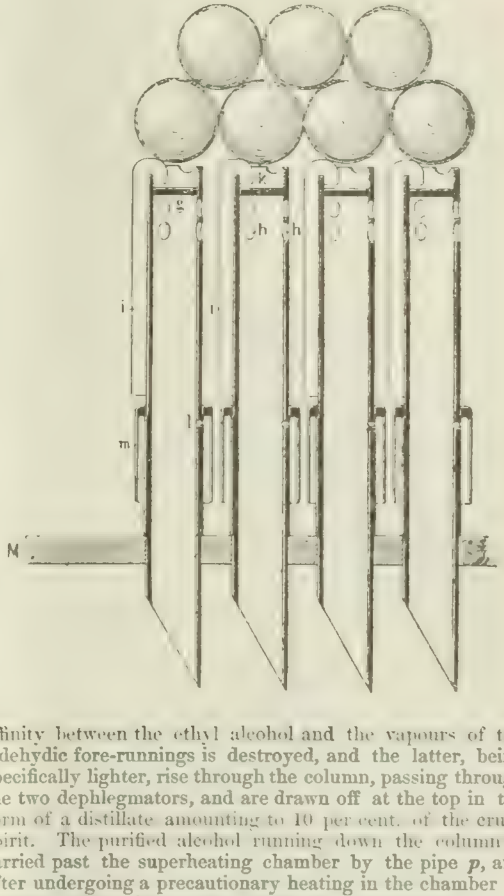
The apparatus described is the invention of R. Ilges, of Bayenthal, and is said to yield 90 per cent. of fine spirit by a continuous rectification.

Fig. 1.



The crude spirit vapours enter the rectifying column (Fig. 1) by the pipe *a*. The column consists of several sections, B_1—B_6, each pair of which are of larger diameter than the pair below them. These sections are filled with massive balls (Fig. 2) of a suitable material; the liquid, condensed in the dephlegmator C, is returned by the pipe *b* to the top section, and spreads itself in a thin layer over the balls. The floor of each section is furnished with a special drop-forming contrivance (Fig. 2), being perforated by a number of small tubes closed near the upper end so as to form little cups, k, separated from the balls by bent wires, *i*, in which the liquid accumulates. It flows down the wires on to the floor M, and enters the tubes by the holes *l*, which are protected by caps, *m*; in the tubes it meets the ascending vapours, and drips uniformly on to the balls in the lower section; the ascending vapours enter the upper section by the holes *h*. When the condensed liquid reaches the bottom, it contains the whole of the after-runnings (fusel oil), and passes through the cooler E (Fig. 1) into the vessel F, where the layer of fusel oil is continuously separated, whilst the water is drawn off at the bottom by the pipe *e*, reheated, and the slightly alcoholic vapours are returned to the rectifier by the pipe *x*.

Fig. 2.



The concentrated spirit vapours from C, entirely free from fusel oil, are conducted to a second column by the pipe *o*. The sections H_1—H_4 of this column are also filled with balls, and provided with dripping plates, M, the sections I_1 and I_2 being dephlegmators. The vapour entering the column at the section G is immediately superheated by means of high-pressure steam in the pipes f, whereby the affinity between the ethyl alcohol and the vapours of the aldehydic fore-runnings is destroyed, and the latter, being specifically lighter, rise through the column, passing through the two dephlegmators, and are drawn off at the top in the form of a distillate amounting to 10 per cent. of the crude spirit. The purified alcohol running down the column is carried past the superheating chamber by the pipe *p*, and after undergoing a precautionary heating in the chamber L, is drawn off continuously at *n* through a condenser.

—J. F. B.

"*Schnaps*," *A New Raw Material for the Manufacture of.* Zeits. für Spiritusind. 1899, **22**, [28], 250.

Attention has been drawn in France to an alcoholic liquor, very rich in aromatic principles, resembling "Schnaps." This spirit is prepared in Algeria by the fermentation of the juice expressed from the fruit of a species of cactus, *opuntia*, commonly called the Barbary fig. This cactus, which is very abundant in the south of France and north of Africa, prefers localities which, on account of the intense heat and absence of moisture, are quite sterile for other plants. 100 grms. of the fruits yield juice containing 14·5 grms. of sugar, and, after a few days' fermentation, 45—50 grms. of pure alcohol are obtained per kilo. of fruits. The systematic cultivation of the cactus has been proposed in France for the utilisation of land otherwise barren. One cactus plant yields 100—200 kilos. of fruit per annum, and 90—100 plants could be grown per hectare. Thus the annual yield of absolute alcohol would be 500—700 litres per hectare, with a minimum of trouble and cost.—J. F. B.

Spirits, Benzene as a Denaturing Material for. Zeits. für Spiritusind. 1899, **22**, [34], 307—308.

The "Verein der Spiritus Fabrikanten" in Germany have proposed to the excise authorities that benzene be legalised as an alternative denaturing agent in conjunction with the usual wood-naphtha-pyridine mixture. The price of the latter is 90—100 marks per hl., whilst benzene only costs 20 marks per hl. Benzene alone, however, does not satisfy the excise requirements, but a mixture of 2 litres of benzene with 1·25 litres of the usual denaturing material has been sanctioned experimentally, for a year, in certain districts. Such spirit is suitable for most ordinary purposes, with the exception that, when burned in the ordinary spirit burners, it deposits soot on the vessel to be heated. This can be avoided by using types of burners which provide sufficient air mixture for combustion. The most suitable benzol is that known as "90's," poor in toluene. When 10 c.c. are shaken with 10 c.c. of water for five minutes, not more than 0·1 c.c. should be dissolved. When distilled, not more than 1 per cent. should come over below 80° C., and 90—94 per cent. between 80° and 100° C. When 5 c.c. of benzol are shaken with 5 c.c. of concentrated sulphuric acid for five minutes and allowed to settle for two minutes, the colour of the acid layer should not be darker than that of a solution of 0·5 grm. of potassium bichromate in 1 litre of 50 per cent. sulphuric acid.—J. F. B.

Alcohol, Denatured: Regeneration with Chloride of Lime. A. and P. Buisine. Rev. Prod. Chim. **2**, [13], 193—194.

The authors consider that Duchemin's application of the Arachequesne method (this Journal, 1897, 156) to alcohol denatured with methyl-ethylketone will not give the result claimed by him, *viz.*, the recovery of 95 per cent. of alcohol of good flavour. The reasons they allege are that acetone oil contains subsidiary malodorous products which are unacted upon by chloride of lime (bleaching powder); and, further, that, even when several times rectified, the regenerated alcohol still retains chlorine compounds, detectable in the flame by means of a bead of copper oxide. Finally, the decomposing action of the chloride of lime on the acetones is incomplete, traces of the latter being subsequently revealed by phenylhydrazine, &c.—C. S.

Diastases, The Secretion of. Dienert. Comptes Rend. **129**, [1], 63—64.

The author has previously shown that yeasts will only ferment galactose after being acclimatised to it, and that the period necessary for this acclimatisation is shortened by circumstances which facilitate the growth of the yeast in presence of galactose, or of melibiose or lactose. In three flasks, containing a nutritive fluid, were placed equal quantities of glucose, galactose, and lactose respectively, and a milk-sugar yeast was added to each. After fermentation, the yeast was removed, dried *in vacuo*, heated to 100° C., and the lactase extracted by water. On then allowing the lactase solution to act on lactose, the amount of lactose inverted by the ferment from the flasks containing the lactose and the galactose was five or six times as great as by that from the flask containing glucose. The same result was obtained when for the lactose yeast was substituted a melibiose yeast. The acclimatisation of the yeast to galactose, then, is accompanied by an increased secretion of these diastases, lactase or melibiase.—J. T. D.

Hops, Spent; The Use of, for Fodder. Wochenschr. für Brau. 1899, **16**, 377—378.

In France, spent hops, mixed with an equal weight of molasses, have been suggested as a cattle food. The mixture is stated to have a higher nutritive value than oats, and to be eaten freely by young cattle.

Various analyses are quoted to show that the value of spent hops from a nutritive point of view is much less than that of oil-cake and hardly equal to that of hay. The statement that the mixture of spent hops and molasses has a higher value than that of oats (*loc. cit.*) is incorrect, for the value of neither ingredient will compare with that of oats. The nutritive value of the dry matter of spent hops is about equal to that of some of the poorer meadow hays.—J. L. B.

Wine, Beer, and Cider; Sulphurous Acid in: Rapid Method of Detection and Determination of. L'Union Pharm. **40**, 288.

See under XXIII., *page* 869

Ferment, Nitrate-reducing Soluble; Presence of, in the Animal Organism. E. Abelous and E. Gérard. Comptes Rend. **129**, [1], 56.

See under XXIV., *page* 871.

"Saccharin" in Wines, Detection of. D. Vitali. Boll. Chim. Farm. **38**, 297; Chem. Centr. 1899, **1**, [26], 1297.

See under XXIII., *page* 869.

PATENTS.

Aërated Liquids, An Improved Form of Carbonator for. E. L. Marley and C. W. Clayton, Fulham. Eng. Pat. 18,881, Sept. 3, 1898.

The carbonator is formed with two aërating chambers, which are connected independently to the liquid-supply pump and the gas supply, the aërated liquid being drawn off from one chamber to the filling or bottling machine whilst that in the second chamber is being aërated, and *vice versâ*. The apparatus is provided with valves controlling the gas and liquid supply, with revolving or other paddles for agitating the contents of both chambers independently, and with valve-controlled outlet-pipes for enabling the liquor to be drawn off from either of the chambers. When the gas is not being used in one of the chambers for aërating purposes, it can be employed in the other to keep up the pressure necessary for the filling operations.—R. A.

Brewing-Pans and the like, Impts. in or relating to Steam-Heating Apparatus for. J. Hall, Manchester. Eng. Pat. 20,238, Sept. 24, 1898.

The inventor claims the combination in a steam coil or other steam-heating system of a return pipe connected with the same boiler and provided with a receiver placed so as to give a good head or fall of water at the boiler level, and an injection tube to deliver the said water column into the boiler. It is mainly on the proper placing of the receiver, and on the size and regulation of the receiving and delivery cones of the injection tube, that the efficient working of the apparatus depends and the water attains sufficient velocity to lift the check-valve and enter the boiler.—J. F. B.

Casks and the like, Impts. in Means for Purifying. T. Whiting, Sparsholt, Berks. Eng. Pat. 20,617, Sept. 29, 1898.

The claims cover the process of purifying foul casks or "stinkers" by treating with lactic acid, or compounds or products containing lactic acid; the use of whey obtained from milk is also claimed. The casks are treated, either entire or in pieces, until the fungous growth or the substance forming the fouling material has been destroyed. This treatment is preferably done in the open, exposed to the air, in order to intensify the action; the casks are finally cleansed with hot water or steam.—J. F. B.

Nucleïn from Yeast, Impts. in the Process of Extracting, and in Preparing Compounds of such Nucleïn with Iron, Silver, and Mercury, Soluble in Water. W. P. Thompson. From K. Schwickerath, Detroit, U.S.A. Eng. Pat. 7184, April 5, 1899.

The nucleïn is first separated from the yeast in a crude, impure state by bringing into solution the albuminous substances and nucleïn by means of an alkali, then precipitating the albuminous bodies by the addition of acetic acid and heating to 75° C., filtering, and precipitating the crude nucleïn from the filtrate by acidulated alcohol. For purification, the crude nucleïn, in neutral or faintly alkaline aqueous solution, is treated with dilute potassium permanganate, the precipitate is filtered off, and the pure nucleïn recovered from the filtrate by precipitation with acidulated alcohol. The claims for preparing the soluble metallic compounds of nucleïn, comprise the addition of a certain quantity of silver, mercuric, or iron salt solution respectively to an aqueous solution, of nucleïn, in presence of a certain amount of free alkali, and the separation of the compound so formed by precipitation with alcohol, with the addition of a small amount of a neutral salt.—J. F. B.

Alcoholic Liquors, Method or Process of Improving. J. T. Knowles. From T. A. Bryan and C. H. Boone, Baltimore, U.S.A. Eng. Pat. 11,107, May 27, 1899.

The object of the process is to improve newly distilled spirits, so as to render them more fit for consumption, by modifying or destroying the fusel oil constituents. The process consists in adding purified methyl alcohol to the liquor and subsequently subjecting the latter to the influence of light or to the influence of waves of radiant energy developed by an electric lamp.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—FOODS.

Edible Cotton-Seed Oil. Chem. and Druggist, Aug. 26, 1899, 370.

In an article in a recent issue of the *Lancet* the claims of cotton-seed oil as a useful food and a substitute for more familiar fats, are discussed. The late Dr. Campbell Morfit paid considerable attention to the purity of cotton-seed oil for edible and pharmaceutical purposes, and in a paper communicated by his daughter, containing observations connected with his researches on this subject, it is stated that the exceptional capacity of assimilation which chemically pure cotton-seed oil possesses could be demonstrated by five years' experience of its use in severe chronic dyspepsia. The stomach, though intolerant of every other fat, even of butter, retained daily a small quantity of cotton-seed oil with nourishing results unobtainable from any other food. Further, cotton-seed oil is much less nauseous than cod-liver oil and is free from laxative tendencies, so that it may be used in the case of tuberculous patients where excessive waste is to be combated without overtaxing the digestive functions. It has also been suggested as a suitable food for growing children and as a lubricant in massage treatment. If in bleaching cotton-seed oil such refining agents are used as will act upon the impurities alone, leaving the oil itself chemically untouched, a bright golden oil is obtained, possessing a sweet nutty flavour, and evincing no sign of becoming rancid. Such an oil is well adapted to edible and culinary purposes.

Cocoa Shells [for Cattle Food], Composition of. F. T. Shutt. Annual Report on Experimental Farms (Canada) for the Year 1898, 151.

A sample of this waste product from the cocoa and chocolate factory, had the composition: moisture, 5·12; albuminoids, 16·44; fat, 12·92; carbohydrates—sugar, &c., 45·43; fibre, 13·17; and ash or mineral matter, 6·92 per cent.; and contained the following amounts of fertilising constituents: nitrogen, 2·63; phosphoric acid, 0·98; and potash, 2·59 per cent.

The author considers that, provided this by-product be fairly digestible, it is a concentrated feeding material of high order. It should be noted that the material is rich in fertilising constituents, more especially in nitrogen and potash, and that these would, for the most part, be recovered in the solid and liquid excreta of the animals fed with the material. —A. S.

Pepsin, The Action of Heat on. V. Harlay. J. Pharm. Chim. **10**, [3], 105—107.

It is found that the prolonged action of heat exerts a retarding influence on peptic digestion. The ferment is destroyed in aqueous solution at a temperature approximating to 68° C., and is rendered less active at 60° C., as shown by the difference in the optical rotation of the solution of the products of digestion. Pepsin dissolved in pure water is more resistant to the action of heat than when dissolved in physiological (acid) solution; in the latter, as A. Mayer has previously shown, the ferment is destroyed at between 55°—60° C. —J. O. B.

Flour, An Examination of. H. Kraemer. J. Amer. Chem. Soc. 1899, **21**, 650.

See under XXIII., *page* 865.

Milk, New and Accurate Method for the Estimation of Fat in. A. A. Bonnema. Chem. Zeit. 1899, **23**, [51], 541.

See under XXIII., *page* 869.

Hops, Spent; The Use of, for Fodder. Wochenschr. für Brau. 1899, **16**, 377.

See under XVII., *page* 850.

PATENT.

Cacao Butter, Impts. in and relating to the Manufacture of. A. C. M. Rieck, Hamburg. Eng. Pat. 19,160, Sept. 8, 1898.

The improvement consists in grinding the roasted and hulled beans into coarse particles of about the size of grain, instead of, as in the ordinary methods of extraction, to a fine paste. The mass thus ground, can be subjected to a considerably higher pressure than is ordinarily possible, without fear of solid particles being forced through the filter-press along with the oil. It is stated that the residue will contain only about 10 per cent. of oil instead of the usual 30 to 35 per cent., whilst a further advantage is that the oil being free from solid particles, requires no subsequent filtration.—C. A. M.

(*B*.)—SANITATION; WATER PURIFICATION.

Water, Sterilisation of, by Means of Ozone. E. J. McWeeney. J. State Medicine, 1899, **7**, [8], 462—467. From Th. Weyl. Centralbl. für Bakt. **26**, [1].

Th. Weyl shows that:—

(1.) Ozone produces an arrest of bacterial development.

(2.) The passage of 13·8 mgrms. of ozone is capable of sterilising 800 c.c. of water (containing 1,250 germs per c.c.).

(3.) By far the greater portion of the ozone is not used up in its passage through the water to be sterilised.

Experiments were also made on the simultaneous action of ozone and iron on sewage effluents, the iron being introduced in the form of wire gauze into the wash-bottles containing the effluent, and the "ozonised" air passed through. It was found that more complete clarification and sterilisation was attained in this way than by using either of the reagents alone. The number of germs and the amount of oxidisable organic matter were certainly diminished by the action of iron and "non-ozonised" air, but the decrease was far inferior to that brought about by iron in conjunction with ozonised air. The treatment with ozone and iron is particularly applicable in the case of effluents containing a large amount of oxidisable organic matter, and also when organisms which liquefy gelatin, are present. It is stated that the oxidisable organic matter is reduced with ozone alone by 50·9 per cent., with iron and non-ozonised air by 61 per cent., and with iron and ozonised air by 87 per cent. whilst the organisms which liquefy gelatin are hardly influenced by air and iron, are imperfectly got rid of by ozone alone, but are completely destroyed by ozone and iron. The applicability of the ozone and iron treatment to the purification of drinking water was ascertained by treating 40 litres of water, which had been artificially contaminated with a "Dibdin effluent enormously rich in bacterial life," with 40 litres of air containing 20 mgrms. of ozone and in presence of 100 discs of iron wire gauze. It was found that the number of germs was reduced to 1 per cent. of the original—27,000 germs being reduced to 264. With iron and non-ozonised air, the number of germs was reduced to 14,000, or, roughly, by 50 per cent. The experiments indicate that the treatment with ozone and iron will be of use in clearing water of the so-called humous substances, to which the peaty colour of upland surface-water is due.

An "ozone-waterworks" has been established by Weyl at Charlottenburg, the main feature of which is a tower (in this case 14½ ft. high) down which the water flows through a layer of coarse stones, meeting with the ozone on its passage downwards. The ozonised water flows from the lower part of the tower directly into the pipes, the rate of delivery being 3·5—4 cb. m. per hour. Before entering the tower, the water is subjected to a rough process of filtration, to free it from scraps of linen, paper, and living fishes, &c. All pumping, ozone-producing, and other work is done by electricity. The cost of active ozone is estimated to be 3,255 marks or rather more than 162*l.* per kilo.; and the cost of 1 cb. m. of water sterilised by ozone, 0·35805 pf. If the water entering the works be of very bad quality, more ozone might be needed, with, of course, a corresponding increase in the cost of purification. In conclusion, Weyl considers that the ozone process is preferable to sand filtration on the following grounds:—

(1.) Sand filtration is uncertain, germs passing through the filter; and defects in the working can only be detected by bacteriological tests, which take at least three days, during which time, contaminated water may be supplied to the consumers. With the ozone process, on the other hand, if every portion of the water be brought into contact with the ozone, the resulting liquid is free from germs.

(2.) The cost of building and maintaining an ozone installation is much less than the cost of sand-filtration.

Weyl considers that the method of sterilisation by means of ozone will enable surface-water to be more largely made use of for supplying towns than has hitherto been possible.
—A. S.

Water, Estimation of the Hardness of. L. Vignon and L. Meunier. Rev. Gén. des Mat. Col. 1899, **3**, [31], 240.

See under XXIII., *page* 865.

PATENTS.

Sewage, Crude, and Trade Effluent, An Improved System for Taking Out the Solids of, before Turning On to the Filter Beds. J. Thomas and S. Charlesworth, Liversedge. Eng. Pat. 15,508, July 15, 1898.

The purpose of this invention is, briefly, to operate on sewage flowing along a channel, by causing the solid matters to be deflected, by baffles, into subsidiary channels ending in a well, from which the sludge is raised by bucket pumps, for discharge into a receiver.—G. H. B.

Sewage, Impts. in the Treatment of. F. M. Spence and D. D. Spence, Manchester. Eng. Pat. 16,217, July 26, 1898.

Sewage effluents, as obtained by precipitation methods of treatment, are usually turbid, from the presence of soapy matters, and are liable to clog the soil when used in irrigation. By the inventors' process, a clear effluent is produced by adding to the sewage, along with sulphates of iron and alumina, so much sulphuric or hydrochloric acid as to decompose all soapy matters, and to give to the treated sewage a slightly acid reaction. The precipitate containing all the fatty matter of the sewage is separated by filtration. The resulting sludge is dried and extracted by a volatile solvent, to remove and recover the fatty matters, and to produce a manure free from fat. The effluent obtained by this process can be used on land for an indefinite time without clogging. See also Eng. Pats. 11,463, and 11,574 of 1898, by the same authors (this Journal, 1899, 602).
—G. H. B.

Sewage or other Foul Liquid on Filter Beds, Improved Apparatus for Use in Distributing. W. M. Ducat, London. Eng. Pat. 17,090, Aug. 8, 1898.

This invention relates to a receptacle which discharges automatically its contents of liquid when the latter has flowed in to a certain height. The apparatus is of simple construction, and consists of the receptacle fitted with an arm carrying a counterpoise, and movable about a pivot.
—G. H. B.

Sewage Effluents, Improved Method of Effecting the Purification of, and in Appliances employed therewith and therefor. R. H. Reeves, Putney. Eng. Pat. 20,118, Sept. 22, 1898.

Plots of land are prepared for the reception of sewage effluent by being interspersed with pot holes formed of perforated bricks or pipes. If the upper surface of the land be of sand or gravel, the pot holes will suffice to distribute the sewage effluent to the kind of soil needed for the filtration or purification; but if the sandy stratum lie deeper, it becomes necessary to bore down through each pot hole to such depth, and to keep the bore hole open by a suitable lining of earthenware or metal.—G. H. B.

Filter Bed Construction, Impts. in and connected with the Supply and Withdrawal of Liquid to or from Filter Beds, and in. S. H. Adams, Harrogate. Eng. Pat. 26,406, Dec. 14, 1898.

The liquid is supplied to, or withdrawn from, the filter beds by means of automatically-acting siphon apparatus. An air escape pipe or chamber is connected to a part of the siphon, in which a quantity of air is trapped while the liquid is rising in the siphon, and this escape pipe is opened, through the action of a float valve, &c., when the liquid reaches a predetermined height, thus permitting the escape of the air and the consequent starting of the siphon. A number of siphons may be employed in series for filling or emptying a number of filter beds. The siphon may also be made to revolve, for the delivery of the liquid to a number of filter beds. The liquid is preferably supplied through a series of small pipes or channels, rather than through a single large pipe or channel.—R. A.

Carbonating Apparatus [*Water, &c.*], *Impts. in.* D. Boyle, New Jersey, U.S.A. Eng. Pat. 12,361, June 14, 1899.

The carbonating chamber consists of a vertical cylinder, into the upper end of which the liquid is discharged through a rose or spray. The gas is admitted at one or more points beneath the discharge point of the liquid supply pipe. A set of inclined blades or paddles, mounted on a revolving shaft, is arranged above each gas inlet, and beneath each inlet is a perforated partition. The lower end of the chamber forms a temporary reservoir for the carbonated liquid, and is surrounded by a coil forming a portion of the liquid supply pipe, a ball-float in this part of the chamber controlling the liquid supply. The coil and the lower part of the chamber are enclosed in a cooling jacket. The top of the chamber is provided with a mechanically-operated vent valve, which serves also as a safety valve to relieve excessive pressure.—R. A.

(*C.*)—DISINFECTANTS.

Petroleum Products, [*Phenols, &c.*], *Disinfectant Properties of, and their Employment for the Impregnation of Wood.* K. W. Charitschkow. Zeits. angew. Chem. 1899, [31], 737—739.

The author examined as to their antiseptic properties, petroleum residue (masut), the oils obtained by distillation of the residue, and the petroleum phenols and their compounds, "petroleum soaps." It was found that the petroleum residue and the heavy oils from the distillation of the residue, possess no antiseptic properties.

On the other hand, however, the petroleum phenols and many of their compounds are distinguished above all other petroleum products by their pronounced antiseptic characters; they are particularly useful for the preservation of wood.

With regard to disinfecting power, the free petroleum phenols are better than their "soaps," of which the copper compounds are the most effective, followed by those of iron, zinc, and aluminium, those of the alkalis and of the alkaline earths possessing no disinfecting power.

The experiments show that 1 per cent. of the free phenols or of their compounds is sufficient to prevent the development of any kind of the lowest organisms.—A. S.

"Egols"; New Class of Antiseptics. E. Gautrelot. Comptes Rend. **129**, [2], 113.

See under XX., *page* 854.

PATENT.

Sterilisation of Liquids by means of Ozone, An Improved Process of and Apparatus for the. M. Otto, Neuilly-sur-Seine, France. Eng. Pat. 15,151, July 9, 1898.

The inventor describes an elaborate apparatus for forming an emulsion of ozonised air with the liquid to be sterilised, and injecting this direct into the storage receptacles, which are then corked. The action of the ozone on the putrescible matters is accompanied by the production of a phosphorescent light, and the action endures long enough to insure the sterilisation of the receptacle as well as the liquid.

—G. H. B.

XIX.—PAPER, PASTEBOARD, Etc.

Wood-Pulp [Sulphite], Resin Stains in. Papier Zeit. 1899, **24**, [68], 2625.

Specks of resin cause much trouble to the sulphite-cellulose manufacturer; they appear as dark, yellowish lumps in the pulping machine, and when dried on the cylinders produce the well-known yellow stains which often degrade a first quality cellulose so much as to render it quite unfit for the better qualities of paper. These stains are more frequent with wood cut in the summer than in the winter. It is pointed out that these stains were never found in the older soda-cellulose process, and that this process was accompanied by a formation of turpentine. It is suggested that in some way the alkaline process might be combined with the sulphite process, so as to decompose the resin into turpentine as in the soda process. A note is, however, appended, remarking that the sulphite liquor employed is acid, and would be neutralised were soda added.—J. F. B.

Paper, Bleaching of, by Electro-Chemical Means. A. Navarre. Chem. Zeit. Rep. 1899, **23**, [22], 219. (From L'Ind. électro-Chim. 1899, **3**, 49.)

Hermite's process has two disadvantages: ordinary dynamos cannot be used by reason of the voltage being too high, and the ampèreage too low; and the wires leading the current to the platinum positive plates (which are placed between the zinc negative plates) are quickly oxidised by the gases evolved. Corbin has arranged his apparatus in such a way that the current is supplied only to the outermost plates, whilst between these is a series of platinum plates insulated from one another and forming secondary electrodes. These secondary electrodes are supported by insulating frames attached to the sides of the insulated vat. A series of chambers is thus formed into which the electrolyte (sodium chloride solution) is introduced from below. Each electrolytic vat in the installation at Lancey contains 13 platinum plates, and using a current of 150 ampères at 120 volts, absorbs 25 H.P.; it can treat 750 kilos. of material in 24 hours. The process is much cheaper than that of chloride of lime bleaching.—W. G. M.

Paper, Influence of High Temperatures on the Strength of. W. Herzberg. Mitt. a. d. kgl. techn. Versuchs-anst. Berlin, 1899; through Papier Zeit. 1899, **24**, [61], 2343.

The only data on this question are embodied in a paper by Lenz (Papier Zeit. 1895, [54—55]), giving results for a paper specially prepared from pure hemp. His conclusions were that temperatures below 100° C. had practically no effect on the paper even after 95 hours' exposure. At 100° C., changes took place with marked decrease in tensile strength and elasticity, but without appreciable change in weight. The decrease of the tensile properties increased with the duration, and proceeded more rapidly as the temperature was raised. For a duration of two hours, changes were first observed at 140° C., and above this temperature, the decrease in strength was nearly proportional to the increase of temperature. Assuming that what takes place at a high temperature is similar, but at a quicker rate, to what happens at ordinary temperatures, the author thinks that data such as these will prove of great value as an indication of the relative durabilities of different papers.

Influence of Drying at 98° C. on Tensile Properties of Paper.

—		Machine Direction.		Cross Direction.		Mean.				Moisture of Paper.
		Breaking Length.	Extension.	Breaking Length.	Extension.	Breaking Length.	Relative Value.	Extension.	Relative Value.	
		Km.	Per Cent.	Km.	Per Cent.	Km.		Per Cent.		Per Cent.
I.—Animal-sized deed paper from the year 1839. Linen with addition of cotton. Ash 4·0 per Cent.	Before drying.........	3·84	4·2	2·57	4·2	3·21	100·00	4·2	100·00	6·5
	After 12 hours' drying.	3·54	4·0	2·56	4·3	3·05	95·01	4·2	100·00	6·1
	„ 24 „ „	3·69	3·7	2·69	4·6	3·19	99·37	4·2	100·00	6·5
	„ 48 „ „	4·01	3·7	2·63	4·1	3·32	103·42	3·9	92·85	5·2
	„ 96 „ „	3·73	3·7	2·56	4·1	3·15	98·13	3·9	92·85	6·1
	„ 142 „ „	3·97	3·4	2·56	3·8	3·27	101·86	3·6	85·71	5·6
	„ 262 „ „	3·41	3·3	2·39	3·4	2·90	90·34	3·4	80·95	4·9
	„ 382 „ „	2·51	1·4	2·47	3·2	2·49	77·57	2·3	54·76	4·5
	„ 502 „ „	2·69	1·8	1·59	1·5	2·14	66·66	1·7	40·47	4·5
	„ 622 „ „	2·06	1·0	1·59	1·3	1·83	57·00	1·2	28·57	4·2
	„ 862 „ „	1·79	0·7	1·36	0·8	1·58	49·22	0·8	19·04	4·0
II.—Resin-sized deed paper. Linen, cotton and wood cellulose. Ash 10·8 per Cent.	Before drying.........	5·20	2·5	3·92	5·2	4·56	100·00	3·9	100·00	6·1
	After 12 hours' drying.	5·00	2·2	3·77	4·3	4·39	96·27	3·3	84·61	5·8
	„ 24 „ „	4·96	2·1	3·52	4·3	4·11	90·13	3·2	82·05	6·2
	„ 48 „ „	4·75	1·9	3·57	3·5	4·16	91·22	2·7	69·23	5·1
	„ 96 „ „	4·15	1·6	3·29	3·3	3·72	81·57	2·5	64·10	5·8
	„ 142 „ „	4·13	1·3	3·26	2·2	3·70	81·14	1·8	46·15	5·2
	„ 262 „ „	3·39	1·0	2·64	1·5	3·02	66·22	1·3	33·33	4·7
	„ 382 „ „	3·17	0·8	2·39	1·2	2·78	60·96	1·0	25·64	4·5
	„ 502 „ „	2·60	0·7	2·05	0·9	2·33	51·09	0·8	20·51	4·3
	„ 622 „ „	2·41	0·6	1·99	0·7	2·20	48·24	0·7	17·94	3·8
	„ 862 „ „	2·03	0·3	1·78	0·5	1·88	41·22	0·4	10·25	3·3
III.—Resin-sized ordinary or scribbling paper. Wood cellulose. Ash 3·3 per Cent.	Before drying.........	7·24	1·6	4·50	5·1	5·87	100·00	3·4	100·00	6·9
	After 12 hours' drying.	7·26	1·4	4·01	4·1	5·64	96·08	2·8	82·35	7·0
	„ 24 „ „	6·81	1·5	3·78	3·3	5·30	90·28	2·4	70·58	6·9
	„ 48 „ „	6·23	1·3	3·26	3·0	4·76	81·09	2·2	64·70	6·8
	„ 96 „ „	5·82	1·1	2·99	1·7	4·41	75·12	1·4	41·17	5·6
	„ 142 „ „	4·50	0·9	3·00	1·5	3·75	63·71	1·2	35·29	5·2
	„ 262 „ „	4·11	0·6	2·38	0·9	3·25	55·36	0·8	23·52	6·7
	„ 382 „ „	3·92	0·5	2·88	0·7	3·40	57·92	0·6	17·64	5·0
	„ 502 „ „	3·42	0·5	2·05	0·6	2·74	46·67	0·6	17·64	6·2
	„ 622 „ „	3·38	0·4	2·32	0·6	2·85	48·55	0·5	14·70	6·1
IV.—Unsized printing paper. Linen, cotton, wood and straw celluloses. Ash 17·0 per Cent.	Before drying.........	2·42	1·6	1·64	3·0	2·03	100·00	2·3	100·00	5·0
	After 12 hours' drying.	2·32	2·0	1·65	2·9	1·99	98·02	2·5	108·69	4·7
	„ 24 „ „	2·41	1·7	1·67	2·6	2·04	100·49	2·2	95·65	4·4
	„ 48 „ „	2·31	1·4	1·55	2·1	1·93	95·07	1·8	78·26	4·9
	„ 96 „ „	2·08	1·2	1·43	1·6	1·76	86·69	1·4	60·86	4·1
	„ 142 „ „	1·71	0·9	1·26	1·2	1·49	73·39	1·1	47·82	3·8
	„ 262 „ „	1·44	0·7	1·03	0·7	1·24	61·08	0·7	30·43	4·7
	„ 382 „ „	1·40	0·5	1·01	0·9	1·21	59·68	0·7	30·43	3·1
	„ 502 „ „	1·08	0·4	0·87	0·4	0·98	48·27	0·4	17·39	4·1
	„ 622 „ „	1·25	0·4	0·81	0·5	1·03	50·73	0·5	21·73	4·3

He gives in the preceding table results of exposing four sorts of paper to a temperature of 98° C. for several hours. Each determination is the mean of five tests, and the results in both directions of the sheets are given. Strips of paper were heated in an oven at 98° C. for six hours each day, samples were withdrawn from time to time, and allowed to reabsorb moisture by remaining 1—2 hours in a chamber of 65 per cent. humidity. All the papers after 622 hours' heating had lost about 50 per cent. of their strength, and 70—80 per cent. of their elasticity, but the times of resistance of the samples varied, and should be in some degree a measure of their relative lives. It was incidentally observed that the paper did not reabsorb the original amount of hygroscopic moisture after drying, and that the decrease of moisture reabsorbed, increased with the duration of heating.—J. F. B.

PATENT.

Paper, Impts. in the Manufacture or Treatment of. W. A. Hall, Vermont, U.S.A. Eng. Pat. 19,324, Sept. 10, 1898.

In Eng. Pat. 12,208, 1897 (this Journal, 1898, 597), the inventor described a "facing" composition for paper, in which the adhesive material (casein) was rendered finally insoluble by means of formaldehyde. He now finds that when casein is precipitated with a mineral acid in the usual way, if the product be only washed sufficiently to leave 0·5 or 1 per cent. of acid in it, then dissolved in alkali and the clay, &c. added, the facing remains soluble for some time, and does not become insoluble and resistant to water till after the lapse of a few days. By this improvement, therefore, the use of formaldehyde is avoided, and there is no danger of clogging the coating machine.—F. H. L.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Colloidal Metals. A. Lottermoser. Pharm. Zeit. **44**, [47], 411—412.

Colloidal Bismuth.—The author, like Vanino and Treubert, prepares colloidal bismuth by the reduction of a bismuth salt with stannous oxide, operating in a caustic ammonia solution, and obtaining the colloidal metal as a black precipitate, which dissolves to a dark brown solution in water, from which the metal may be precipitated by either salts or acids. Colloidal bismuth so obtained is not pure, as, in spite of repeated solution in water and reprecipitation with ammonium citrate, it still contains a large proportion of tin, which is difficult to separate. The author therefore concludes that in the reduction processes made use of by himself and others, a mixture of colloidal bismuth and stannic acid is obtained. The author also obtained *colloidal silver* an colloidal stannic acid by the reduction of silver salts with stannous salts.

Colloidal mercury (in which, as is well known, Haehnel first pointed out the presence of considerable quantities of the impurities, tin and ammonium) contains tin as colloidal stannic acid, which cannot be got rid of by the usual processes. The author has also made *colloidal copper* by the interaction of stannous chloride and cuprous or cupric chloride; in weak acid solution, in the presence of a large excess of reducing agent, the reduction is complete. The results, however, are different when an exactly neutral or an alkaline solution is used; neutral solutions of stannous chloride and cupric chloride, on addition of sodium citrate, give, on heating, a colourless solution from which an extremely fine precipitate of metallic but insoluble copper separates in the form of bright glistening crystals. If, on the contrary, alkaline solutions of both salts be used (the author has always used more of the tin salt than is required according to the equation $CuCl_2 + SnCl_2 = Cu + SnCl_4$), the copper being kept in solution by the addition of sodium citrate, on heating, a white turbidity is at first obtained, which changes from yellow to red, and finally becomes black. The precipitate is colloidal copper, mixed with colloidal stannic acid, and may be dissolved in water to a reddish-black solution.

In conclusion the author remarks that the drying of all colloidal metals, formed by the action of a stannous salt as a reducing agent, is attended with the greatest difficulty, since, as soon as an attempt is made to free them to any extent from accompanying impurities, they lose their solubility when dried in a vacuum over sulphuric acid. Colloidal mercury, which has been brought into commerce under the title "Hygrol," has this disadvantage, which is due to the great difficulty in separating the tin.—J. O. B.

Hydrogen Peroxide. C. T. Tyrer (Brit. Pharm. Conf.). Pharm. J. **63**, [1518], 100—101.

The experiments recorded indicate the preservative value of various agents on solutions of hydrogen peroxide, and also the vessels which are best suited for the storage and transport of that body. Hydrogen peroxide solutions of various initial strengths, from 12 to 30 volumes, were employed, the addition of 1 per cent. of each of the following substances being made:—Glycerin, sulphuric acid, hydrochloric acid, boroglyceride, alcohol, and phosphoric acid of sp. gr. 1·5; the amount of available oxygen was periodically determined. Hydrochloric acid proved to be the least efficient protective agent, and phosphoric acid the most. Champagne quart bottles and soda-water bottles were found most satisfactory as containers, since these are less liable than other vessels to burst during carriage. Corks are preferable to glass stoppers.

For laboratory use, the peroxide should be stored in a vessel with a bottom tap, and a protective layer of paraffin should cover the surface of the liquid.

It is not generally known that by careful evaporation, hydrogen peroxide may be concentrated to 50 or even 100 volumes of "available" oxygen, but the accidental contact of the least trace of dust causes a violent, almost explosive evolution of gas. The evaporation should therefore be conducted *in vacuo*.—J. O. B.

Cream of Tartar, Manufacture of High-Grade. A. Martignier. Rev. Prod. Chim. **2**, [10], 147—148.

To remove the calcium tartrate present, the author employs hydrochloric acid or sulphuric acid in quantities slightly in excess of the calcium salt, the acid being added during the process of refining the red crystals, and again during the second purification. The crystallised product contains, on an average, 99 per cent. of potassium bitartrate. The tartaric acid from the decomposed calcium salt remains in the mother-liquor, and can afterwards be converted into calcium tartrate in the usual manner.—C. S.

"Egols": New Class of Antiseptics. E. Gautrelet. Comptes Rend. **129**, [2], 113—114.

These bodies are the potassium-mercury salts of orthonitrophenolparasulphonic acids, the individual members being termed "Phenegol," "Cresegol," &c., according to the phenol from which they are derived. They are very stable compounds, the mercury being removable only by heating with soda-lime or by the prolonged action of hydrochloric acid and potassium chlorate. On calcination, the mercury is transformed first into thiocyanate, then into sulphide. The egols are red-brown powders, difficult to crystallise, very soluble in water, insoluble in alcohol. The aqueous solutions are devoid of smell or taste, neutral, neither caustic nor irritant, and do not coagulate albumins. They are not actively poisonous, and if given regularly in small doses are eliminated from the system as rapidly as they are given, producing no apparent effect. They are strongly bactericidal.—J. T. D.

Pinene Hydrochloride, Apparent Varying Optical Rotation of. J. H. Long. J. Amer. Chem. Soc. 1899, **21**, 637—642.

The very wide divergence in the optical properties of pinene hydrochloride or artificial camphor, as given by different investigators, the author regards as due to the presence of impurities in the products examined. The pure compound is readily obtained in good yield by passing hydrochloric acid gas into oil of turpentine which has been purified with alkali and subsequent fractionation. Some fresh American oil was dried by means of potassium carbonate, then treated with metallic sodium until all action ceased, and finally distilled, the greater part boiling at 156°—158° C., and having a specific rotation $[\alpha]_D = + 14^{\circ}\cdot 65$. The hydrochloride was prepared from two portions of this oil, one being kept cool by ice and salt, the other being allowed to stand in the air; in the latter case, the separation of hydrochloride was slower, but in the end as complete as in the other case, and when purified by twice recrystallising from alcohol, both products gave the specific rotation $[\alpha]_D$ at $20^{\circ} = + 7\cdot 17^{\circ}$. Hence the temperature at which the artificial camphor is formed has no important effect upon its properties.

The author is of opinion that the oil from any one plant contains both dextro- and lævo-pinene, and, since these cannot be separated by distillation, the usual methods of obtaining the dextro-modification from commercial American oil are fallacious; the dextro- and lævo-hydrochlorides cannot be separated by fractional crystallisation.

The melting point of the hydrochloride, stated by Pesci and others to be 125° C., is incorrect, the true value being 131° C., as given by Riban.—T. H. P.

Hederine and Ivy, Physiological and Toxicological Study of. A. Joanin. Comptes Rend. **128,** [24], 1476—1478. (See this Journal, 1899, 784.)

Hederine acts as an emetic and cathartic. Its action is very powerful. Some of the symptoms due to poisoning by ivy are those produced by hederine, but others seem to point to the existence in the plant of another principle, acting on the nervous system.—J. T. D.

Opium Alkaloids, Order of Basicity and Thermal Constants of. E. Leroy. Comptes Rend. **129,** [4], 220—223.

The author has determined the heats of formation of the hydrochlorides of opium alkaloids as follows:—

	Base, Solid.	
—	HCl in Solution. Salt in Solution. Cal.	HCl, Gaseous. Salt, Solid. Cal.
Codeine	9·27	29·74
Morphine	7·18	27·97
Thebaine	6·93	24·31
Papaverine	4·15	26·48
Narcotine	2·33	21·72

This order of basicity agrees with the action of the bases on indicators, for whilst codeine acts on both litmus and phenolphthaleïn, the three following bases act only on litmus, and narcotine does not affect either indicator. The whole of the experimental figures, from which those above are deductions, are given in the paper.—J. T. D.

Cardamoms, Essential Oil of. E. J. Parry (Brit. Pharm. Conf.). Pharm. J. **63,** [1518], 105.

Seeds obtained from authentic samples of Ceylon-Malabar and Ceylon-Mysore cardamom fruits were employed as the source of the oils, which gave the following figures:—

—	Yield.	Specific Gravity.	Optical Rotation.
	Per Cent.		° ′
Ceylon-Malabar seeds	1·3	0·9418	+ 40 41
Ceylon-Mysore seeds	2·6	0·9418	+ 46 39

These figures agree fairly with those given for Malabar cardamom oil, but do not accord with the statement of Schimmel for those of the Ceylon variety, which is given as being sp. gr. 0·895 to 0·901, and rotation + 12°. The author finds but little difference in the chemical constituents of these two oils. The esters present are chiefly acetates, formic acid, recorded by Weber, not being detected with certainty. From 5 to 10 per cent. of cineol are present; limonene occurs among the terpenes, and a small quantity of terpineol is present in both oils.—J. O. B.

Extractors, Continuous, for Volatile Solvents. E. Melckebeke. Bull. Assoc. Belge des Chim. **13,** [5], 242.

See under XXIII., *page* 863.

Acetic Acid instead of Alcohol as a Menstruum in Extractions, Cinchona Analysis, &c. E. R. Squibb. Chem. and Druggist, Aug. 26, 1899, 360.

See under XXIII., *page* 869.

Alcohol and Ether in the Presence of Petroleum Spirit, The Estimation of. H. D. Richmond. Analyst, 1899, **24,** 201.

See under XXIII., *page* 867.

Ether Extraction, The Use of the Incandescent Electric Lamp as a Source of Heat in. C. G. Hopkins. J. Amer. Chem. Soc. 1899, **21,** 645.

See under XXIII., *page* 864.

Acetic Ether, Utilising the Vapours Produced in Charcoal Making for the Manufacture of. Th. Chandelon. Bull. Assoc. Belge des Chim. **13,** [5], 231—236.

See under III., *page* 823.

Veratrine, The Analysis of Commercial. G. B. Frankforter and L. B. Pease. Amer. J. of Pharm. 1899, **71,** 130; through Analyst, 1899, **24,** 209.

See under XXIII., *page* 870.

"Saccharin," Valuation of. E. E. Reid. Amer. Chem. J. **21,** [6], 461.

See under XXIII., *page* 868.

Alkaloids, New Method for the Acidimetric Titration of. E. Falières. Comptes Rend. **129,** [2], 110.

See under XXIII., *page* 869.

Cantharidin, Determination of. Gehe. Pharm. Central. **40,** 230.

See under XXIII., *page* 870.

PATENTS.

Acetone, Impts. in the Manufacture of. J. L. Hawliczek, Liverpool. Eng. Pat. 15,907, July 21, 1898.

See under III., *page* 824.

[Phenol Esters of Dibasic Acids], Fine Chemical Products for Use in Pharmacy and other Purposes, Impts. in the Manufacture of. H. S. Wellcome and S. B. Schryver, London. Eng. Pat. 16,994, Aug. 6, 1898.

The first claim is for the preparation of acid phenol esters of organic dibasic acids by a process which consists in acting upon the sodium phenolate with the acid anhydride in an inert solvent, and decomposing the resulting sodium salt by a mineral acid. Many examples are given. The second claim is for the use of esters prepared by this process, and their metallic, alkylic, and phenylic salts for therapeutic and other uses.—A. C. W.

Tartaric Diphenyl Ester as a Preparation for Medicinal Purposes, An Improved Process for Producing. W. P. Thompson, Liverpool. From J. U. Kreis, Munich, Germany. Eng. Pat. 17,303, Aug. 10, 1898.

The process claimed consists in heating normal potassium tartrate and phenol with phosphorus oxychloride on the water-bath for some hours, pouring into water, neutralising the oil, washing with water and alcohol, and finally recrystallising from alcohol.—A. C. W.

Piperidine, The Manufacture of a New Product [Salicylate] from. J. T. Hewitt, London. Eng. Pat. 19,823, Sept. 19, 1898.

Piperidine salicylate is claimed as a new product, together with the process for its preparation, which consists in mixing solutions of piperidine and salicylic acid in suitable solvents, and evaporating.—A. C. W.

Methyl Morphine (Codeïne) and Ethyl Morphine, An Improved Method of Manufacturing. E. Kauder, Darmstadt, Germany. Eng. Pat. 18,050, Aug. 22, 1898.

The process is claimed for the manufacture of ethyl and methyl morphine, which consists in acting upon the alkali or alkaline earth compounds of morphine in suitable solvents (alcohol) with methyl or ethyl phosphate.—A. C. W.

Piperazine Quinate and Quinates of Piperazine Derivatives and their Alkali Salts, Manufacture of. C. D. Abel, London. From Benno Jaffé and Darmstaedter, Berlin. Eng. Pat. 11,420, June 1, 1899.

The processes claimed for the manufacture of quinates of piperazine and its derivatives, consist in melting the base with the acid (2 mols.), and in mixing solutions of the base and acid, and eliminating the solvent or precipitating the salt. The alkali derivatives are obtained by the addition of alkali carbonates to the piperazine quinates. The products are also claimed.—A. C. W.

Chloral Combinations, Manufacture of New. A. J. Boult, London. From R. Wagnitz, Berlin. Eng. Pat. 19,103, Sept. 7, 1898.

The claims are for various compounds of chloral and the processes for producing them, which consist in dissolving the substance to be combined with chloral in a terpene alcohol, such, *e.g.*, as menthol, or in glycerin, and adding chloral; in dissolving boric acid, milk sugar, salicylic acid, &c., in glycerin, driving off water by heat, and adding chloral; in combining bromo- or iodomenthol or terpineol with chloral; and in adding magnesia and basic magnesium carbonate to the products of the processes described.—A. C. W.

Aromatic Ether [Methylanthranilate], The Manufacture of an. C. D. Abel, London. From The Actiengesellschaft für Anilin Fabrikation, Berlin. Eng. Pat. 19,868, Sept. 19, 1898.

The methyl ester of anthranilic acid is obtained by saturating a solution of anthranilic acid in methyl alcohol by hydrochloric acid gas, distilling off most of the alcohol, and decomposing the ester salt with sodium carbonate. The oil is then washed, and distilled *in vacuo*. Methyl anthranilate forms colourless crystals with a blue fluorescence, melting at 25° C. and boiling at 127° C. under a pressure of 11 mm. It is characterised by a sweet and intense smell of orange blossoms.

The process and product are claimed.—A. C. W.

Alkylised Uric Acids, Impts. in the Manufacture or Preparation of. G. W. Johnson, London. From C. F. Boehringer und Soehne, Waldhof, Mannheim, Germany. Eng. Pat. 1678, Jan. 24, 1899.

The patentee claims the process for the manufacture of alkyluric acids, which consists in the reduction of oxymethylene-uric acids. The reducing agent employed is tin and hydrochloric acid; the preparations of 7-methyluric acid, 3,7-dimethyluric acid, and 1,3,7-trimethyluric acid (hydroxycaffeine) from the corresponding 7-oxymethylene uric acids, are given as examples.—A. C. W.

Nucleïn from Yeast, Impts. in the Process of Extracting, and in Preparing Compounds of such Nucleïn with Iron, Silver, and Mercury, soluble in Water. W. P. Thompson. From K. Schwickerath, Detroit, U.S.A. Eng. Pat. 7134, April 5, 1899.

See under XVII., *page* 850.

XXI.—PHOTOGRAPHY.

Diamidophenol, Retarding Action of Solutions of, on Dry Plates. E. Valenta. Chem. Zeit. 1899, **23**, [22], 220.

The author has experimented with the various retarding agents, and confirms Mercier's statement in regard to diamidophenol. If a 0·02 per cent. solution of this substance be exposed to the action of air until it has acquired a violet colour, it will be found that a dry plate dipped into it will, after drying and exposure, give a good dense negative with the hydroquinone developer, if the over exposure be considerable. Metaphenylenediamine acts in the same way as the oxidised diamidophenol. After dipping the plate for two minutes in a 0·1 per cent. solution of this reagent a badly over-exposed plate gave a good negative. The ratio of exposures of a previously prepared plate and of a similar but unprepared plate, according to the Scheiner sensitometer, was 1:23.—W. G. M.

Ammonium Persulphate in Photography. A. and L. Lumière. Photography, 1899, **11**, 323; from Chem. Zeit. Rep. 1899, **23**, 184.

To further substantiate their theory as to the action of ammonium persulphate on the denser parts of a negative (see this Journal, 1898, 870), and to show that metallic silver is precipitated on the negative (a fact disputed by Namias), the authors have prepared a double compound of silver ammonium persulphate by the action of precipitated silver on a 5 per cent. solution of ammonium persulphate. This double salt, in the presence of a reducing agent (say pyrogallic acid or hydroquinone), actually precipitates silver on a negative, thus playing the part of a physical strengthener, without reducing the silver directly in the solution.—S. K.

Copal Varnish for Negatives, The Use of Epichlorhydrin for the Manufacture of. E. Valenta. Phot. Corr. 1899, **36**, 333; Chem. Zeit. Rep. 1899, **23**, 184.

See under XIII. B., *page* 844.

PATENTS.

Gelatin, Impts. in the Manufacture of Spangles and other Articles from. A. Zimmermann, London. From The Chemische Fabrik auf. Actien vormals E. Schering, Berlin. Eng. Pat. 19,325, Sept. 10, 1898.

See under XIV., *page* 846.

Fabrics, Photographic Print; Impts. in. J. A. Harvey, Toronto, Canada. Eng. Pat. 6010, March 20, 1899.

See under V., *page* 828.

XXII.—EXPLOSIVES, MATCHES, Etc.

Cordite, Some Properties of. The late Sir William Anderson. Proc. Inst. Civil Eng. **136**, ii, 1898–99, 1—14.

In the course of a brief reference to the method of manufacturing cordite in use in the Government factories, the author calls attention to the effects of certain typical explosions which have occurred, showing that destruction of surrounding objects is far less than is commonly supposed. Thus, an accidental explosion of 3,700 lb. of nitroglycerin at Waltham Abbey only did serious injury to property within a radius of 95 yds., whilst a large quantity of nitroglycerin in an adjoining building was not detonated.

The most dangerous part of the manufacture of cordite is that concerned in the drying of the guncotton, and especially when the last few per cents. of moisture are being driven off. In former times the guncotton was dried in a loose condition, but now the moist material is pressed into blocks, which give off less dust during the drying. This dust is particularly liable to spontaneous ignition, and the greatest caution is needed in its presence. The drying of the guncotton blocks is effected by warm air at a temperature of 100° F. A stove containing 4,212 lb. of dried guncotton, just at the end of the drying process, was the scene of an accident, caused presumably by the spontaneous ignition of the warm, dry dust. A bright flame shot up into the air with a loud roar, but nothing occurred in the nature of an actual explosion. The light roof of the stove was blown off, and the woodwork was set on fire, but neighbouring constructions were not injured. The smallness of the destructive effect of this explosion must be ascribed to the guncotton being in the form of compact blocks, which burn away comparatively slowly.

An explosion of a quite similar kind occurring at Arklow, but caused by the ignition of only 275 lb. of dry guncotton, was accompanied by considerable destruction to surrounding objects; in this case the guncotton was in the form of a loose flocculent mass, allowing of a very rapid communication of the primary ignition.

The dry guncotton is mixed with the nitroglycerin by the bare hands of the men, and the mass is put into mixing machines along with 20 per cent. of acetone. After incorporation for 3½ hours, 5 per cent. of vaseline is added, and the whole is then worked together for 3½ hours. The stiff dough which results is squirted by pressure through nozzles of sizes varying according to the diameter of the cordite required. The cords are then subjected to drying operations in order to get rid of the acetone. Occasionally the charge of cordite dough becomes ignited in the squirting machine, but only a small portion of the charge becomes consumed, the major part remaining unaffected. In order to secure uniformity of ballistics, the cords, when thoroughly dry, are blended by mixing a large quantity together. Cordite can be exploded by concussion, but the explosion is confined to the part struck; the fire is not communicated to the free portions on each side.

Experiments are described showing that cordite only burns explosively when confined in strong receptacles; when stored in light boxes, an ignition of the cordite results only in a flare-up, the lids, in many cases, being forced up only sufficiently to allow the gases to escape. This is a striking difference to the mode of burning of black powder.

The ballistic power of cordite is very nearly four times that of black powder, due chiefly to the difference in the volume and temperature of the gases produced on explosion. Cordite has a specific gravity of 1·56. It can give a pressure, on explosion, of more than 120 tons per square inch, compared with 43 tons, the maximum pressure attainable with black powder. In practice, cordite occupies only a fraction of the space in the powder chamber, so that the pressure, on firing, does not rise above 17 tons. The regularity of the burning of cordite can be utilised with great advantage by employing it in guns specially constructed, when high service energies can be attained in guns of comparatively light weight.

The ballistic results are somewhat influenced by changes of temperature of the cordite, but not to the extent of modifying the shooting under service conditions. In prolonged cold weather the nitroglycerin sometimes exudes slightly, but exhaustive experiments have proved that the ballistics are unaffected by it.

The author remarks on the common but erroneous supposition that cordite has a greater erosive action on the bores of guns than black powder, whereas, if the greater energy developed be taken into account, the comparative wear on the guns would probably be favourable to cordite. The nature of the erosion in the two cases is essentially different, that from cordite being far more regular, as well as being capable of compensation by the employment of suitable driving bands or obturating rings. The author has been able to compare the effects of cordite and black powder after firing upwards of a thousand rounds from 4·7-in. quick-firing guns, and records his belief that the endurance of cordite guns will be found to be considerably greater than those using black powder, in spite of their increased ballistics.

Cordite is unaffected by water, whether fresh or salt. Even when fired wet from a gun, the ballistics only fell off to the extent traceable to the evaporation of the water. Although the combustion of cordite yields about 34 per cent. of the poisonous carbonic oxide gas, no inconvenience has been experienced from its presence.

The ignition of a charge of cordite cannot be effected by ordinary tubes, so a primer of ordinary black powder is used for passing on the fire to the charge. In the case of small arms, where the cordite is of small diameter, all that is required is a stronger cap, filled with a composition giving a long flame.

The following data for calculating ballistics have been determined by direct experiment:—

Atmospheric pressure	2,116 lb. per sq. ft.
Volume of products of combustion of 1 lb. of cordite at atmospheric temperature of 32° F. (or 491°·10 absolute)	14·021 cb. ft.
Temperature of explosion	6532°·3 F. absolute.
Estimated specific heat of gases at constant volume	0·34
$y = \frac{\text{specific heat at constant pressure}}{\text{specific heat at constant volume}}$	1·23
Heat evolved by exploding 1 lb. of cordite and expanding to atmospheric pressure and 32° F. temperature	2,054 B.T.U.

The following table gives a list of eight cordite guns in which the calculated and observed muzzle energies are compared:—

Gun.	Ratio of Volume of Chamber to Total Volume of Bore.	Weight of Cordite Charge.	Muzzle Velocity.	Chamber Pressure.	Muzzle Energy.		Ratio of Actual to Calculated Muzzle Energy.
					Actual.	Calculated.	
		Lb.	Foot-Secs.	Tons.	Foot Tons.	Foot-Tons.	
12-inch wire	0·2555	167·5	2,361	16·00	32,850	34,585	0·95
9·2 „	0·2512	94·5	2,674	17·13	18,860	19,700	0·96
8-inch service	0·2487	32·6	2,150	13·81	6,731	6,843	0·98
6 „	0·2685	14·75	1,960	12·1	2,664	2,948	0·90
6-inch quick firing	0·1094	13·25	2,154	12·95	3 217	4,127	0·78
4·7 „ „	0·0858	5·44	2,150	14·0	1,442	1,797	0·80
4-inch service	0·1075	3·56	2,342	14·5	945	1.094	0·86
3-inch, 12 cwt.	0·1874	15·00	2,280	13·6	450·5	543·8	0·83

—G. H. B.

Guncotton and Smokeless Powders, Stability of. C. Hoitsema.

Zeits. für angew. Chem. 1899, **30**, 705—710.

The author has previously shown (Zeits. für phys. Chem. 1896, **21**, 137; 1898, **27**, 567) that if guncotton be subjected to very gentle and careful heating *in vacuo*, it is gradually decomposed into a black residue and gaseous products, consisting, at the beginning, of a small quantity of the higher oxides of nitrogen, but, later on, of nothing but nitrogen and nitric oxide. He now considers that the unstable bodies in guncotton give rise to the higher oxides of nitrogen, whilst the stable guncotton only yields nitrogen and nitric oxide. On these grounds he proposes an apparatus and method for testing the stability of guncotton. The apparatus consists of two glass stoppered U-tubes connected together, in the first of which is placed from 1—2 grms. of guncotton. The second contains some glass wool, moistened with Guttmann's reagent (Diphenylamine dissolved in sulphuric acid). The tube containing the guncotton is then placed in an oil bath for a quarter of an hour at, say, 110° C. At the end of this time a current of dry carbonic acid is passed through the apparatus for a short time, when it will be found that the diphenylamine has developed the blue colour due to the presence of higher oxides of nitrogen. The process has then to be repeated in the same manner, but at a temperature 10° C. lower each time, until a point is reached at which no blue coloration is produced, and this temperature is taken as the indication of stability. It will be seen that the author proposes to substitute a temperature test for the time test now in general use. The work of Thomas (Zeits. für phys. Chem. 1898, 1028) and his proposed stability test, by heating guncotton at 94°—96° C. until red-brown fumes of oxides of nitrogen are observed, are also discussed in the light of the author's views. The following table gives a comparison of the results obtained by Abel's heat test at 80° C., Thomas' test as described above, and the author's own method :—

Sample.	Abel's Test.	Thomas' Test.	Hoitsema's Test.
	Minutes.	Days.	°C.
Guncotton Stowmarket	4	9—11	100
Guncotton Walsrode	33—39	10—10½	100
Guncotton Kruppamuhle	12	5	100
Flake powder Muden	35	6—8	80
Flake powder Colln-Rottweil	7—9	8—8½	80
Ballistite Muden	23—27	6½—8	70
Ballistite Daneberg	13	Hours. 5½—6	80
Cylinder-powder Muden	48	Days. 5½	90
Cylinder-powder Duneberg	60	7—8	90

—G. W. McD.

Phosphorus Trisulphide, Poisonous Properties of. Frouin. Chem. Zeit. Rep. 1899, **23**, [22], 213. (From La Semaine méd. 1899, **19**, 221.)

For more than a year phosphorus trisulphide has been used in the manufacture of lucifer matches. But its industrial use is, according to the author, to be condemned, since, in contact with the moisture of the skin, it evolves hydrogen sulphide; and, probably by reason of the formation of volatile phosphorus compounds, the vapours are said to be more poisonous than those of ordinary phosphorus.
—W. G. M.

Headless Matches. R. Höland. Chem. Zeit. 1899, **23**, 614—615.

In reference to numerous articles advertising headless matches, which have been published in German newspapers, the author points out that, whilst it is true that these matches do not glow after the flame has been extinguished, and in this respect may be said therefore to be superior to Swedish or safety matches, they possess the great disadvantage of containing the very poisonous barium chlorate. There is thus danger of direct poisoning, and also by means of the fumes emitted on ignition. Although, moreover, these matches do not require preliminary dipping in sulphur or paraffin, the alleged objection to the use of paraffin on account of the poisonous nature of its fumes, is quite groundless.—E. W. W.

Acetic Ether, Utilising the Vapours produced in Charcoal Making, for the Manufacture of. Th. Chandelon. Bull. Assoc. Belge des Chim. **13**, [5], 231—236.

See under III., *page* 823.

PATENTS.

Explosives, Impts. in the Manufacture of. A. G. Dawson, Westminster, and J. Karstairs, Crayford, Kent. Eng. Pat. 8470, April 9, 1898.

A novel explosive manufactured from urea, ethyl alcohol, and nitric acid. Urine is concentrated to one-tenth of its volume at a temperature not exceeding 60° C., and then mixed with one-third of its volume of methylated spirit. To this mixture is added carefully two-fifths of its weight of nitric acid (1·45). The crystals which gradually separate are, after drying at a temperature not above 25° C., ground up and mixed with 5—15 per cent. of caoutchouc dissolved in naphtha, and this pasty mass can be pressed into any suitable form. The explosive is said to be unaffected by any degree of moisture or temperatures up to 100° C. Smaller proportional quantities of nitric acid and alcohol are used for a weaker explosive.—G. W. McD.

Explosives, Impts. in or connected with the Treatment of. F. W. Jones, Barwick, Hertford. Eng. Pat. 15,553, July 15, 1898.

This patent relates to the regulation of the combustion of gelatinised powders. The grains are coated with a non-explosive substance, such as carnauba wax or ceresine, by revolving them in a drum with the finely divided material. The extent of the coating is regulated by the length of drumming. In special cases, covering material, like dinitrotoluene (which, when heated, has a solvent action on the grain), may be used.—G. W. McD.

Matches, A New or Improved Igniting Composition to be employed in the Manufacture of. P. Ward, London. Eng. Pat. 17,957, Aug. 20, 1898.

Red or amorphous is substituted for yellow phosphorus in match heads. The composition of the igniting paste is given as follows :—

Soaked glue (1 to 5 of water)	37·0
Powdered glass	7·5
Whiting	7·5
Amorphous phosphorus (pure)	10·0
Paraffin wax	4·0
Chlorate of potash	27·0
Sugar or lamp black	7·0

Silicate of soda may be substituted for the glue, bichromate of potash added for damp climates, and sulphur for large matches.—G. W. McD.

Explosives, Power of; An Improved Method of and Apparatus for Measuring the. C. E. Bichel, Hamburg, Germany. Eng. Pat. 18,273, Aug. 25, 1898.

This invention describes a method of measuring the power of explosives, consisting in effecting the ignition of the explosive by an electric spark in a chamber partially or perfectly evacuated or filled with an inert gas, and permitting the resulting gases to act upon an indicator which traces a curve on a rotating drum. Details are given of the electric firing apparatus.—G. W. McD.

Explosives, Impts. in the Manufacture of. W. H. Cromie, London. Eng. Pat. 19,074, Sept. 7, 1898.

This invention is based on the discovery that, by regulating the strength of the acid mixture and the temperature of working, a nitrocellulose is produced containing a high percentage of nitrogen, and consisting solely of soluble nitrated cotton. By immersing one part of cotton in 30 parts of a mixed acid containing 58 per cent. of H_2SO_4, 29 per cent. of HNO_3, and 13 per cent. of H_2O at 70° F. for 10 minutes, and allowing 24 hours for after-nitration, a guncotton is produced containing from 12·44 per cent. to 12·5 per cent. of nitrogen, and completely soluble in ether-alcohol. It is claimed that from this particular nitrocellulose, powder can be produced of great purity and high density (1·62).
—G. W. McD.

Explosive Substance for Firearms, Improved Process for the Production of an. R. F. Leuschel, Weida, Germany. Eng. Pat. 8409, April 21, 1899.

Certain plants and stemless mosses are treated with alkaline solutions, and subsequently with hydrochloric acid and bleaching powder, for the purpose of purification and disintegration. The leafy parts are then dried and pulverised, and are used as an absorbent for carbohydrate solutions, such as sugar, caramel, dextrin, or glycerin. After drying, this material is nitrated, and the body so obtained is steeped in a solution of saltpetre, with or without chromic acid salts. With the aid of a solvent, the product may be granulated. Cotton wool impregnated in the above manner is said to yield a better nitrated product.
—G. W. McD.

Explosive, An Improved. T. H. Kelly, G. W. Bell, and R. N. Kirk, all of Sydney. Eng. Pat. 8679, April 25, 1899.

This invention relates to the discovery that "green eucalyptus leaves contain an explosive element of great potency," which is incorporated with nitroglycerin, nitrate of potash, calcined leaves, and cork dust. Green eucalyptus leaves are soaked in sulphuric acid (sp. gr. 1·84) for one hour, and after pressing and washing, are further soaked in nitric acid (sp. gr. 1·5) for the same time. The pulp so produced is washed and dried, at a temperature not above 40° C. The acids from the foregoing operation, containing spirit of eucalyptus, are mixed and used in the manufacture of nitroglycerin, which latter (80 parts) is kneaded with nitrate of potash (10 parts), calcined leaves (7·5 parts), and cork dust (2·5 parts).—G. W. McD.

Fire Crackers, Impts. in. **J. R. Hinton, Petersburg, U.S.A. Amer. Pat., Nov. 26, 1898. Eng. Pat. 9099, May 1, 1899.**

In firing "cannon crackers" accidents frequently occur from handling the same when the fuse has apparently gone out, but in reality contains sufficient fire to ignite the charge unexpectedly. The object of this invention is to provide a means whereby there can be no explosion unless it is preceded by a harmless combustion, giving a loud whistling sound, produced by a chemical compound which at the same time acts as a fuse for igniting the cannon charge. The claim is for a tube (projecting into the cannon chamber) containing a combustible whistling composition, an igniting fuse at the firing end, with a layer of powder between the fuse and composition, and another layer between the composition and cannon charge. The whistling composition which is picrate of potash, is made by dissolving picric acid in hot water, and adding magnesium carbonate. To the picrate of magnesium thus obtained, potassium nitrate is then added, when picrate of potassium is precipitated.

—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Still-Heads for Fractional Distillation, Relative Efficiency and Usefulness of Various Forms of; with a Description of some New Forms possessing Special Advantages. S. Young. Trans. Chem. Soc. 1899, 679—710.

When a mixture of two liquids is distilled from an ordinary distillation bulb with a short vertical still head, the amount of separation is small, especially when the boiling points of the components are close together. The satisfactory separation necessitates a series of systematic fractional distillations, and consequently the time required is great and the loss of material considerable. Numerous modifications of the form of the still-head have been proposed, with the object of effecting a more complete separation of the components of the mixture in a single distillation, by means of a process of fractionation in the still-head itself. It is stated that with two still-heads of equal efficiency, that one is the more useful which allows of the distillation of the smaller quantity of liquid, and since the smallest quantity of substance that can be usefully distilled must be considerably greater than that of the liquid and vapour always present in the still-head, it is of great importance that the latter be constructed in such a manner that, consistently with efficiency, the quantity of condensed liquid in it at any moment shall be as small as possible.

The author has made a number of experiments with a mixture of equal weights of benzene and toluene, both of constant boiling point, in order to ascertain what form of still-head gives the best results, not only as regards efficiency, but in other respects. It was found that the rate of distillation had a very marked influence on the results, a very much better separation being effected by diminishing the rate of distillation. In order to regulate the rate more carefully, and to be able to readily time the drops during

Table I.

Nature of Still-head.	Short plain tube, medium width (int. diam. 15·5 mm.).	Plain tube, medium width (int. diam., except at bottom, 14 mm.).	Long plain tube, medium width (int. diam. 14·3 mm.).	Very narrow plain tube (int. diam., except at top and bottom, 5·1 mm.).	Narrow plain tube (int. diam., except at top and bottom, 8·0 mm.).	Wide plain tube (int. diam., except at top and bottom, 19·4 mm.).	Very wide plain tube (int. diam., except at top and bottom, 25·7 mm.).	Narrow tube, No. V., ends vertical; greater part sloping gently upwards.	Narrow tube, No. V., ends vertical; greater part bent into spiral.	Plain tube, II., with central glass rod with 20 disc-shaped enlargements.	Tube with 3 bulbs.	Tube with 7 bulbs.	Tube with 13 bulbs.	Tube with 13 pear-shaped bulbs. "Pear" still-head.	"Hempel" tube with 200 beads; bulb above.	"Evaporator" still head, with 3 sections and 2 bulbs.	"Evaporator" still-head, with 5 sections and 2 bulbs.
Vertical height from bottom to side tube in cm.	12	62	120	70	70	67	67	28·5	32	62	26	42	66	62	58	58	75
Approximate internal surface in sq. cm. ..	60	270	543	129	187	378	480	187	187	377	about 175	about 325	about 550	?	?	?	?
Temperature range.	Percentage weight of distillate.																
80·2°— 83·2°	..	..	..	..	..	..	..	..	..	1·4	..	0·2	1·4	3·0	*20·6	15·4	†30·6
83·2°— 86·3°	..	0·1	1·0	0·5	0·4	1·3	0·2	3·5	8·0	18·1	2·2	14·2	24·4	26·2	15·4	19·6	10·0
86·3°— 89·4°	2·1	12·8	19·4	22·2	16·2	15·2	20·0	24·8	22·6	15·8	18·8	18·0	10·2	11·0	7·2	6·2	3·8
89·4°— 92·5°	28·4	21·5	16·6	16·5	18·3	19·4	18·8	14·0	11·6	9·7	18·4	12·0	7·9	5·8	3·4	5·1	2·3
92·5°— 95·6°	18·0	11·0	10·6	9·2	11·7	11·2	9·2	9·3	8·8	6·1	9·4	5·1	6·0	5·2	3·2	3·5	1·6
95·6°— 98·7°	10·9	8·9	7·2	7·2	8·7	8·6	7·2	6·7	5·5	4·2	7·8	6·4	3·7	2·4	2·2	2·9	1·7
98·7°—101·8°	8·6	7·4	6·5	5·8	7·5	6·1	4·7	5·6	5·0	3·8	6·7	4·6	3·6	2·4	1·8	2·6	1·5
101·8°—104·8°	7·2	6·2	6·0	5·5	5·8	5·6	5·9	5·4	5·5	4·2	5·8	4·8	3·4	2·8	2·9	2·4	1·8
104·8°—107·9°	7·2	7·3	6·1	5·9	6·9	6·6	6·4	6·3	6·0	4·3	6·4	5·6	3·4	3·6	3·2	3·8	2·9
107·9°—110·3°	6·8	8·4	7·8	7·1	8·2	9·5	10·0	8·2	7·4	8·0	8·0	6·2	6·2	5·0	6·8	5·8	4·8
110·3°—110·9°	5·9	9·0	8·1	8·9	9·5	8·0	7·2	9·0	10·7	6·6	10·0	10·4	8·0	11·0	8·4	10·8	8·2
110·9° (by difference)	4·9	7·4	10·7	11·2	6·8	8·5	10·4	7·2	8·9	17·8	6·5	12·5	21·8	21·6	24·9	21·9	30·8
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Weight of vapour and liquid in still-head†.	0·3	1·55	3·55	1·05	1·15	2·35	3·15	1·1	0·95	2·35	0·95	1·75	3·55	2·6	7·85	3·45	5·0
Reference number	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.

* Diameter of tube containing beads, 2·5 c.m.

† Means of weights with 100, 50, and 25 grms. of mixture.

distillation, a seconds pendulum was made to swing behind the receiver in which the distillate was collected. In the experiments, the rate, unless otherwise stated, was one drop of distillate per second, and the weight of mixture distilled was 50 grms. The fractions were collected, as a rule, with temperature ranges of 3·0° or 3·1°, except near the boiling point of toluene, where the intervals of temperature were reduced to 2·4° and 0·6°; for it is a general law, so far as the author knows, without exception, that the less volatile of the two components of a mixture is more easily and quickly separated than the more volatile.

In Table I. is given a comparison of the results obtained with a number of different still-heads. The method of determination of the weight of vapour and condensed liquid in the still-head during the distillation, when pure or nearly pure toluene was coming over, is fully described in the original paper.

Plain Vertical Still-Head.—A certain amount of fractionation takes place even with a plain vertical still-head, and the efficiency in this respect is improved by increasing the length of the tube; the weight of vapour and liquid in the still-head also increases with the length, but somewhat more rapidly. For tubes of (approximately) equal length, the efficiency does not bear so simple a relation to the width; with increase of width, the efficiency first falls until it reaches a minimum, and then rises again. It appears that for a plain still-head, it is more advantageous to use very narrow tubing than very wide.

Regulated Temperature Still-Head.—If the still-head is surrounded by water kept at a temperature as little above the boiling point of the more volatile component as will allow of vapour passing through, a considerable improvement is effected in the separation, and this form of still-head is specially useful for very volatile liquids. A tube bent in the form of a spiral is better than a straight one, as it is more efficient, and the effective length of the still-head is thereby greatly increased without unduly increasing the height of the bath. The temperature of the bath, however, requires very careful regulation, and the author cannot recommend this form of still-head for liquids boiling above 70° or 80° C.

Sloping and Spiral Still-Heads.—The inefficiency of the plain vertical still-head is due to the want of thorough contact between the vapour and condensed liquid, owing, firstly, to the central portion of the vapour passing rapidly up the tube, and, possibly, never meeting with the liquid at all; and, secondly, to the condensed liquid flowing down very rapidly away from the vapour back into the still. A considerable improvement is effected, especially in the separation of benzene, by making the middle part of the still-head slope gently upward. The efficiency is further improved by bending the sloping portion of the tube into the form of a spiral, probably because a better admixture of the vapour is thus produced.

Rod and Disc Still-Head.—This is a still-head of the form shown in Fig. 1. The discs are formed by heating a small part of the rod in the blow-pipe flame, and when quite soft, pressing the glass together, when it is forced out into the form of a nearly flat disc. The glass tripods which are fused on at each end, serve to centre the rod, and the lower one rests on the constricted part of the vertical still-head. This apparatus (with 20 discs) was found to give good results, better even—when the same quantity of liquid was distilled—than those given by the 3-bulb Le Bel-Henninger, and much better than those with the 3-bulb Glinsky dephlegmator. A slight further improvement, both in efficiency and as regards the quantity of liquid in the still-head, is effected by constricting the outer tube between the discs.

Bulb Still-Head.—The results obtained by using a vertical tube with a series of bulbs blown on it, as recommended by Wurtz (Ann. Chim. Phys. 1854, **42**, [3], 129), show that the efficiency increases regularly with the length of the tube and the number of bulbs. The results are at variance with the statement of Kreis (this Journal, 1885, 113)—quoted without comment in some recent standard works on chemistry—that a Wurtz tube with four bulbs gives no better results than one with two bulbs of the same size, and that a tube with four bulbs gives about the same result as one of the same diameter as the bulbs.

Fig. 1.

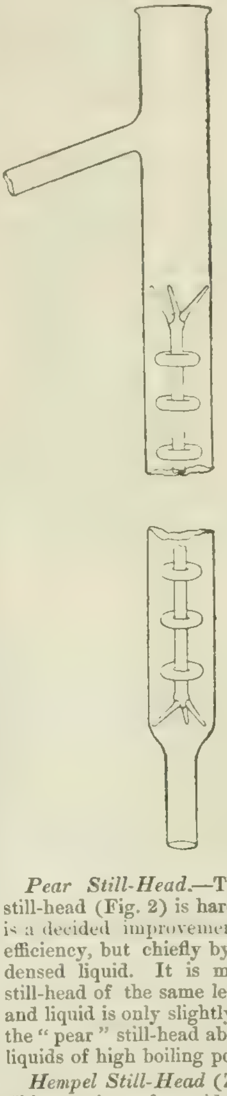
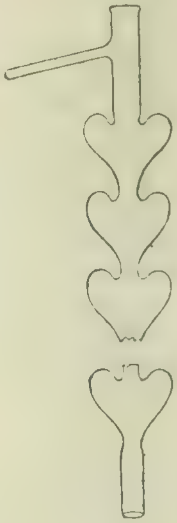


Fig. 2.

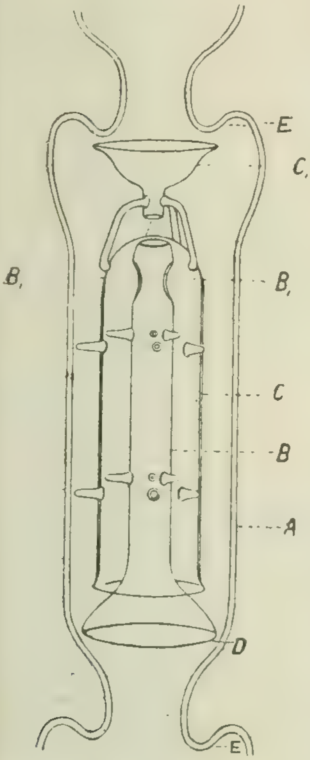


Pear Still-Head.—This modified form of the Wurtz still-head (Fig. 2) is hardly more difficult to construct, and is a decided improvement on the latter—to some extent in efficiency, but chiefly by diminishing the quantity of condensed liquid. It is more efficient than a rod and disc still-head of the same length, whilst the amount of vapour and liquid is only slightly greater. The author recommends the "pear" still-head above all others for the separation of liquids of high boiling point.

Hempel Still-Head (Zeits. anal. Chem. 1881, **20**, 502).—This consists of a wide vertical tube with a constriction made in it near the bottom. The beads must be made to arrange themselves over the constriction in the form of a dome (Gewölbartig), and must remain quite securely even when the liquid being distilled boils with bumps. A short narrower vertical tube with a side delivery tube is fitted by means of an ordinary cork into the wide tube containing the beads. The Hempel still-head is very efficient and easy of construction; its great disadvantage is the excessive amount of condensed liquid in the still-head, which makes it unsuitable for the distillation of small quantities.

"*Evaporator*" *Still-Head.*—The author has devised an apparatus in which a considerable part of the condensed liquid is reconverted into vapour, whilst at the same time very thorough contact is established between the liquid and vapour. In Fig. 3 is shown one of the sections (10—15 cm. long) of this form of still-head. It consists of three separate parts: (1) The outer tube, A, 22—24 mm. internal diameter, connected above and below with other sections. (2) An inner thin-walled tube, B, 7·5—8 mm. internal diameter and 60 mm. long, open at each end and widened below into the form of a funnel, which rests on the constricted part of A, and should fit it fairly accurately. Two holes, B_1, are blown in the sides of B near the top. (3) An intermediate tube, C, about 14 mm. internal diameter and 50 mm. long, like a small inverted test-tube. Above the tube C, and attached to it by three glass legs, is a small funnel, C_1, which must be a little wider than the depression in the tube A just above it. The tubes B and C are centred and kept in position by the little glass projections shown.

Fig. 3.



In carrying out the distillation, the narrow passage, D, where the inner tube rests on the constriction in the outer one, becomes at once blocked by condensed liquid, and the vapour therefore rises up the inner tube and passes through the openings at and near the top of it, then down between the inner and middle tubes, and up again between the middle and outer tubes. It then passes round between the funnel and the depression at the top of the outer tube, and finally up into the next section above. The whole of the liquid condensed in the still-head above any section collects together and flows down the walls, falling in drops from the depression E into the funnel. From this it falls on to the top of the tube, C, and spreads itself over its surface, falling again in drops from the bottom of this tube, and finally passing between the bottom of the inner tube and the constriction in the outer one, and thus into the section below. The formation of spheroidal drops on C may be easily prevented by fusing to the top of the tube a fine needle of glass as shown by the dotted line in the figure. The results given in Cols. XVI. and XVII. were obtained with evaporator still-heads, without the glass needles, and show that vhilst the separation with the still-head with five sections s much better than with the Hempel tube, the weight of rapour and liquid in the still-head is less than two-thirds is great. The author recommends this form of still-head 'or the purpose of purifying small quantities of liquid of noderate boiling point.

Glinsky, Le Bel-Henninger, and Young and Thomas Dephlegmators.—In these dephlegmators, the return flow of condensed liquid is obstructed at definite levels in the vertical still-head, so that the liquid collects into a pool at each level, and the ascending vapour is compelled to force ts way through the pool, thus bringing about very complete ontact between vapour and liquid. The efficiency and useulness of the various dephlegmators depend to a large xtent on the size and arrangement of the reflux tubes. 'he Young and Thomas dephlegmator (this Journal, 1895, 08) has recently been modified by the author so as to llow of it being held safely in any position. The modificaions consist (1) of an enlargement of the reflux tube below he platinum ring, in order to prevent the former from lipping through the ring if the tube is inverted; (2) five iternal projections on the outer tube to prevent the reflux ibe and the ring together from falling out of position when ie tube is inverted. The author states that C. E. Muller as since suggested the apparatus might be further improved y making the reflux tube with a much wider rim at the top, so that this, and not the delicate platinum ring, would come in contact with the projections when the tube was inverted.

In Table II. is given a comparison of the Glinsky, Le Bel-Henninger, and Young and Thomas (modified) dephlegmators, and the rod and disc, pear, and evaporator still-heads. When distilling 400 grms. of the mixture, the results given by the three dephlegmators show no marked difference, the Le Bel-Henninger, however, giving a somewhat better separation of benzene than the others, and the Glinsky a decidedly worse separation of toluene. With 50 grms. of the mixture, the Glinsky tube is far inferior to the others, whilst with the Le Bel-Henninger, the separation of benzene is not quite so good, and that of toluene distinctly worse than with the Young and Thomas apparatus. The Glinsky and Le Bel-Henninger tubes are both inferior to the Young and Thomas when 25 grms. of the mixture are distilled, more particularly with regard to the separation of toluene. With neither of the two first-named tubes was 108° C. reached at the end of the distillation; and also, the residues, especially with the Glinsky tube, contained considerably more benzene than the last drops of distillate, for when distilled from an ordinary bulb, they began to boil at 102·5° C. and 106° C. respectively.

The author gives a description of the requirements which should be fulfilled in the construction of a dephlegmator in order that the best results may be obtained.

(1.) *Ease of Construction and possibility of largely increasing the Number of Sections.*—It is stated that it is almost as easy to make a Young and Thomas dephlegmator with 12 or 18 sections as one with 2 or 3. The effect of increasing the number of sections is clearly shown in the diagram, Fig. 4, where the total weights of distillate are plotted against the temperature. In the diagram the dotted line shows the form that the curve would take if the separation were absolutely perfect. The other curves represent the results obtained as follows:—

Curve.		No. of Sections.	Rate.
			Drops per Minute.
I.	Short still-head....................	..	60
II.	Young and Thomas dephlegmator	3	60
III.	" " "	6	60
IV.	" " "	12	60
V.	" " "	18	60
VI.	" " "	18	30
VII.	Evaporator still-head	5	60

(2.) *Convenience of Handling.*—The reflux tubes, being inside the main tube in the Young and Thomas dephlegmator, are much better protected from breakage, and the apparatus is almost as convenient to handle as a plain, straight tube.

(3.) *Size of Constrictions, &c.*—As the amount of liquid flowing back at any level is greatest at the bottom of the tube and least at the top, it follows that, in order to retard the flow sufficiently to form a pool of liquid for the vapour to rise through, more complete obstruction is required at the top of the tube than at the bottom.

(4.) *Width of Reflux Tubes and Depth of Traps.*—The reflux tubes should not be made wider (in the part that is filled with liquid during the distillation) than is necessary to freely carry back the condensed liquid, and the U-shaped parts, acting as traps, should be no deeper than is required to prevent the ascending vapour from forcing its way through them. If the number of sections be very large, the lower traps should be made rather wider than the upper ones. The upper part of the reflux tubes may be advantageously made fairly wide so as to facilitate the entrance of condensed liquid, and also to prevent bubbles or columns of vapour being caught and carried down with the liquid through the traps. The author considers that the poor results obtained with the Le Bel-Henninger dephlegmator at the highest temperatures on distilling 25 grms. of the mixture, were largely due to the fact that the amount of vapour

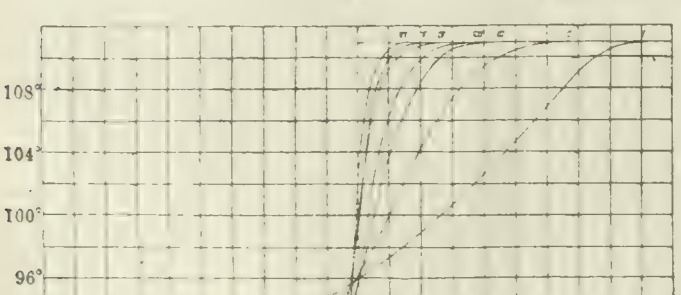
TABLE II.

Nature of Still-Head.	Glinsky Dephlegmator, 3 bulbs.		Le Bel-Henninger Dephlegmator, 3 bulbs.		Young and Thomas Dephlegmator, 3 sections.		Rod and Disc Still-Head, 20 discs (with Constrictions).	Pear Still-Head, 13 bulbs.	Evaporator Still-Head, 5 sections.	Young and Thomas Dephlegmator, 18 sections.
Vertical height from bottom to side tube in cm.	80		43		51†		63	62	75	130
Weight of mixture distilled.	400	25	400	25	400	25	25	25	25	50
Temperature range.	Percentage weight of distillate.									
80·2°—81·2°	..	..	..	..	..	..	..	..	6·2	31·5
81·2°—83·2°	1·2	0·6	0·6	0·4	0·3	0·6	2·2	3·6	22·2	7·3
83·2°—86·3°	19·1	13·2	25·8	13·4	20·3	18·6	17·6	26·2	10·4	4·1
86·3°—89·4°	14·2	15·0	12·1	15·2	13·9	15·2	15·2	8·8	3·2	1·9
89·4°—92·5°	8·7	8·8	9·2	10·0	10·4	7·6	9·6	6·8	2·4	1·8
92·5°—95·6°	6·6	6·8	4·3	7·4	4·5	6·0	5·2	4·0	2·2	1·3
95·6°—98·7°	5·5	6·0	3·1	5·0	4·2	4·6	3·6	2·8	2·2	1·2
98·7°—101·8°	6·1	6·4	4·3	5·2	3·3	3·8	4·2	2·6	1·6	0·9
101·8°—104·8°	3·7	5·2	2·9	5·2	3·4	4·6	3·8	2·8	2·0	1·2
104·8°—107·9°	6·2	20·8	4·8	9·6	3·8	5·6	4·4	3·8	3·4	2·0
107·9°—110·3°	7·1	17·2	6·0	28·6	8·3	9·8	5·6	7·0	5·6	4·0
110·3°—110·9°	10·0		10·4		10·5	7·6	10·0	10·6	5·6	8·1
110·9° (by difference)	11·6		16·5		17·1	16·0	18·6	21·0	33·0	34·7
	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
Weight of vapour and liquid in still-head.	2·8		5·85		2·8		2·2	2·6	5·0	12·1
Highest temperature reached.	110·9°	107·9°*	110·9°	107·65	110·9°	barely 110·9	110·9°	110·9°	110·9°	110·9°
Boiling point of residue.	110·9°	102·5 to 110·7°	110·9°	106·0 to 110·9	110·9°	110·7 to 110·9°	110·9°	110·9°	110·9°	110·9°
Reference number.	XVIII.	XIX.	XX.	XXI.	XXII.	XXIII.	XXIV.	XXV.	XXVI.	XXVII.

* Then fell again to 107·4° as the last few drops came over.
† The Young and Thomas dephlegmator with three sections was unnecessarily long.

and condensed liquid in the still-head is much greater than with the others.

Fig. 4.



(5.) *Flow of Liquid through the Reflux Tubes.*—The flow of condensed liquid through the reflux tubes should be rapid, especially if the latter are outside the main tube and are not heated by the ascending vapour, otherwise the first portions of condensed liquid remain, to a greater or less extent, lodged in the traps, and thus the residue, at the end of the distillation, is found to be richer in the more volatile constituent than the last portions of the distillate. This is the case with both the Glinsky and Le Bel-Henninger dephlegmators, more particularly with the former. The author states that in fractionating tubes of the Glinsky or Le Bel-Henninger type, the upper end of the reflux tube should be wide, and the junction with the bulb should be very low down, so that the quantity of liquid in the pool will be prevented from becoming unnecessarily large, and also more of the liquid will return through the reflux tube, and less will find its way back past the obstruction. Fig. 5A represents a form which is wrong, Fig. 5B one which is right in principle.

(6.) *Arrangement of the Reflux Tubes.*—There should be a reflux tube connecting each bulb with the one below it, so that the change in composition may be regular from top to bottom of the dephlegmator.

(7.) *Return of Liquid from Still-Head to Still after the Distillation is stopped.*—It is a great advantage, if the residua liquid be valuable, that it should return a completely as possible from the still head to the still. In thi respect, the Glinsky is superior to the other dephlegmators but the rod and disc, the pear, and the evaporator still-heads give even better results.

The author concludes, from the results of the investigation, that when only a moderate degree of efficiency is required, either a "rod and disc" or a "pear" still-head of about the dimensions given in Table I. is to be preferred to

Fig. 5A.

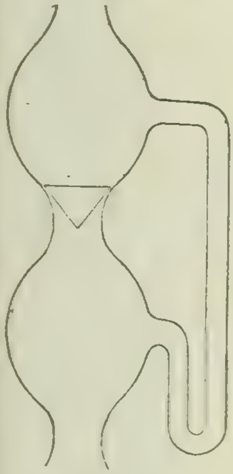
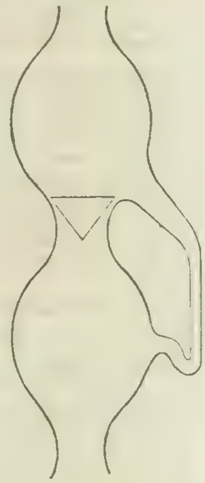


Fig. 5B.



either of the three dephlegmators, as they are simpler and better suited for the distillation of small quantities, and after the distillation is stopped, the liquid returns almost completely from the still-head to the still. If great efficiency be required, either a Young and Thomas dephlegmator or an "evaporator" still-head should be used.

Extractors, Continuous, for Volatile Solvents. E. Melckebeke. Bull. Assoc. Belge des Chim. **13**, [5], 242—245.

These two simple forms of extraction apparatus are designed to obviate the loss of time and risk of breakage incurred in taking apart those of the ordinary type.

Fig. 1.

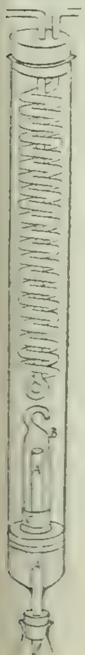


Fig. 2.

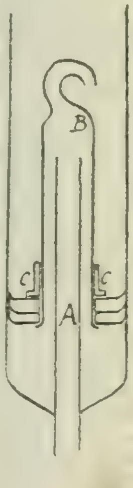


Fig. 4.

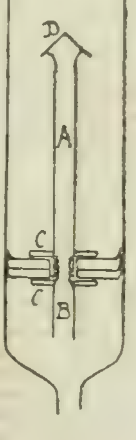
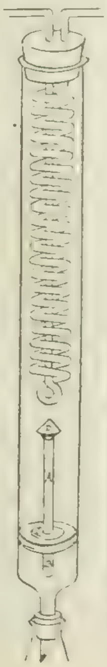


Fig. 3.



The form shown in Figs. 1 and 2 is provided with an overflow, and consists of an outer tube of glass, the bottom of which is traversed by a narrow tube A, extending upwards for a distance of 6—8 cm., and surrounded by a wider tube B, which is drawn out and bent over like a hook at the top and is kept in position by tight-fitting rings of chamois leather and felt, resting against a bottom flange, and retained by a metal collar C. The upper part of the outer tube is occupied by a narrow spiral condenser-tube of copper, the lower end of which is turned back up the centre of the coil.

The vaporised solvent from the boiling flask below ascends *viâ* A and B, and, being condensed by the spiral, falls back upon the substance to be extracted and returns to the flask by overflowing the mouth of A. In this manner the substance remains constantly immersed. When the operation is finished the spiral is removed, and a hooked wire is inserted to withdraw the tube B and the residual mass resting on the felt disc.

For finely powdered substances the direct discharging extractor, Figs. 3 and 4, is more suitable than the foregoing. In this case the bottom extremity of the outer tube is drawn out, and contains a filter composed of two metal tubes, A and B, to which are soldered the discs, C C, for retaining the layers of filtering material. A cap, D, at the top of tube B prevents the substance from entering the latter during filling. By regulating the rate of ebullition in the flask, the solvent can be maintained at a height ensuring the continuous immersion of the substance. It is generally advisable to cover the felt disc with a layer of powdered asbestos if any turbidity in the extract is anticipated; and where the collection of the excess of solvent is desired, a Stoedeler collector can be inserted between the flask and the extractor.

—C. S.

Carbon, The Combustion of, in a Platinum Crucible, P. W. Shimer. J. Amer. Chem. Soc. 1899, **21**, [7], 557—568.

By means of the device illustrated, the waste of gas and heat, and the use of the expensive apparatus required in the ordinary methods of combustion, are obviated.

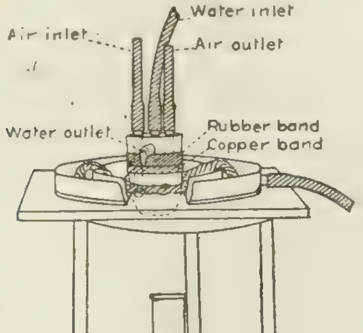
A platinum fusion crucible, about 1$\frac{7}{16}$ in. in diameter and 1$\frac{9}{16}$ in. in height, is fitted closely into a ring of sheet copper about $\frac{3}{16}$ in. wide, so that its extreme top is surrounded. The crucible is closed by means of a water-cooled stopper, made of sheet copper and with brazed joints. It is constructed somewhat smaller than the crucible, and is fitted tightly in place by means of a band of pure black rubber. The water passing through the stopper, and wet wick wrapped round the upper part of the crucible, prevent any burning or softening of the rubber during the combustion, whilst the effect of heat radiation from the bottom of the crucible is obviated by keeping the latter from a third to a half full of ignited asbestos.

The general construction of the crucible stopper, which is the essential feature of the apparatus, is shown in the figure. The arrangement for the combustion of carbon in iron and steel consists of two aspirators containing distilled water, by means of which a current of air is swept through the apparatus; bulbs containing potassium hydrate solution, 1·27 sp. gr.; a guard tube; the combustion crucible connected with a reservoir of distilled water; a cupric oxide tube of porcelain or brass; a glass tube, containing glass beads wet with water and kept cold externally by wet wick, for the purpose of absorbing chlorine and hydrochloric acid; a large calcium chloride tube; and potassium hydroxide bulbs, with a guard tube of calcium chloride.

The steel is dissolved by the standard method with an acidified solution of the double chloride of copper and potassium, the carbon filtered through asbestos, and, when dry, transferred to the combustion crucible, which should have a flat or convex, but never concave, bottom.

For the preliminary weighing of the absorption bulbs, the crucible is filled to about a third of its depth with ignited asbestos, the stopper inserted, and the water passed through, whilst the Bunsen flames heat the crucible and the copper oxide tube. A current of air is passed through the apparatus at a somewhat more rapid rate than in an oxygen combustion for about 20 minutes, after which the bulbs are detached and weighed with the usual precautions.

In the actual combustion the air is passed through at the rate of about three bubbles per second, and a small blast-lamp is placed immediately under the crucible, so that the bottom and about a quarter of an inch of the sides are of a bright red heat. The combustion is complete in about 25 minutes.



If the carbon be filtered through asbestos in a Gooch crucible, the latter may be transferred directly to the platinum crucible.

The author gives the results of a series of parallel determinations of carbon in iron and steel by this method and by the ordinary process of oxygen combustion, which agree excellently.

The method is also applicable to the determination of carbonic acid and combined water in ores, limestone, &c., with slight modifications in the arrangement of the parts of the apparatus. In determining water, the water in the beaker supplying the stopper must be slightly heated in order to prevent the moisture condensing on that stopper, and being drawn under the rubber band to an appreciable extent.

The crucible has also been used for the estimation of iron in iron ores by reduction in hydrogen at a red heat, dissolving the reduced iron in sulphuric acid and titrating it with permanganate. In this case, 0·5 grm. of the dry ore is placed in a small capsule of platinum foil fitting the bottom of the crucible, and roasted for about five minutes to destroy carbonaceous matter. When cold, the stopper is inserted and hydrogen passed through until all air is expelled. The crucible is then heated to a red heat for 30 minutes, allowed to cool in the current of hydrogen, and the reduced iron dissolved and titrated.

The method is not suitable for the estimation of carbon in compounds which yield condensible decomposition products, since these condense on the cool upper part of the crucible and escape combustion.—C. A. M.

Ether Extraction, The Use of the Incandescent Electric Lamp as a Source of Heat in. C. G. Hopkins. J. Amer. Chem. Soc. 1899, **21**, 645—647.

An arrangement for heating a number of Soxhlet extractors is described. It consists of an air-bath in the form of a galvanised iron box, with double side- and triple end-walls, packed with asbestos to diminish loss of heat by radiation. For 20 Soxhlets, this box is 36 inches long, 8 wide, and 6 deep; it has two rows of holes, 10 in each, in the cover, and is heated by means of five incandescent lamps giving 32 candle-power at 110 volts; in this way the heating is very regular, and the extraction may be safely allowed to proceed all night. With the apparatus at work, the temperature of the cover of the bath does not exceed 75° C., but it has been found that the lamps may attain a temperature at which ether ignites; hence, for absolute safety, the bulbs of the lamp should be immersed in water.
—T. H. P.

INORGANIC CHEMISTRY.—QUALITATIVE.

Arsenic, Biological Reaction for. Bujwid. Médicine Moderne; through L'Union Pharmaceutique, **40**, 293.

It is stated that the mould, ***Penicillium brevicaulis***, cultivated on potato at 37° C., in the presence of such minute traces of arsenic (0·00001 to 0·00005 grm.) as would give a barely perceptible deposit with Marsh's test, will evolve a marked alliaceous odour of AsH_3. The liquid, or, in the case of a solid, a small particle moistened with sterilised water, is introduced into a culture tube containing the mould on boiled potato. The culture is then left in the thermostat at 37° C. for 24 hours, when, in the presence of arsenic, the characteristic odour will be obtained.—J. O. B.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Borate of Lime, Estimation of Boric Acid in. R. Schwartz. Chem. Zeit. 1899, **23**, [47], 497.

Hönig and Spitz's method is both quick and accurate; it may be carried out in two ways. (1.) 1 to 2 grms. of the powdered borate of lime are mixed with 5 to 10 c.c. of hydrochloric acid (sp. gr. 1·124) and about 100 c.c. of water, and either digested cold for several hours or heated in a reflux apparatus on the water-bath for a quarter to half an hour. The liquid is filtered, the residue well washed, and the whole filtrate carefully made neutral to Methyl Orange by addition of N/5 caustic soda, which must be free from carbonate. (2.) Into the cold neutralised liquid, carbonic acid is passed for about half an hour with frequent shaking. The flask is closed, allowed to stand about two hours with occasional shaking, the liquid being then filtered, evaporated to about 20 c.c. on the water-bath, neutralised with hydrochloric acid in presence of Methyl Orange, and heated to boiling. The solution obtained from (1), or from the further treatment as described in (2), is made up to 100 or 200 c.c., and 50 c.c. of it, mixed with 50 to 60 c.c. of glycerin, and made up to 150 or 200 c.c. with water, are titrated with N/5 caustic soda, using phenolphthaleïn as indicator. The glycerin must, if necessary, be neutralised beforehand by means of caustic soda and hydrochloric acid. The author recommends that modification of the volumetric method in which the borate of lime is digested in the cold with hydrochloric acid.—T. H. P.

Metallic Sulphides, Separation of, by Means of Hydrochloric Acid Gas. J. Bird Moyer. J. Amer. Chem. Soc. 1899, **21**, 642—645.

By making use of the greater volatility in hydrochloric acid gas of the "acid sulphides" as compared with the more basic metallic sulphides, the author finds it possible to separate the sulphides of arsenic, antimony, and bismuth from lead sulphide, and arsenic sulphide from cadmium and silver sulphides. The mixed sulphides are weighed out into a porcelain boat, which is heated in a combustion tube, through which hydrogen chloride is passed. The experimental numbers show that the separations effected in this way are very complete.—T. H. P.

Assaying Plumbago Crucibles for Gold. F. L. Carter. Eng. and Mining J., Aug. 5, 1899, 155.

The best assayers in the United States, when called in to settle the value of a lot of graphite crucibles, have varied from each other by 40, 60, and, on one occasion, by 100 per cent. One of the causes for these great differences is that when the scorifier containing the material is placed in the red hot muffle, the volatile zinc is evolved very quickly and mechanically carries the very fine gold with it. It is very difficult to get the plumbago to liquefy, and generally a dirty, unfused-looking mass, and very poor results, are obtained. The following was considered the best method for the assay of such material :—

A quantity not exceeding 6—7 grains of the finely powdered material is taken, but if the proportion of gold present be so small that a satisfactory gold bead cannot be obtained with this quantity, the lead buttons from several assays are combined. The bottom of a large scorifier is rubbed with silica, then 40 grains of pure litharge introduced, followed by the plumbago and 4 grains of nitre. The materials are mixed together, 30 grains of litharge added, and finally a covering of borax. The temperature of the muffle should be very low at first, and after remaining so for a few minutes, be gradually raised to a white heat, when it will be found that the mass has fused completely. To ensure accuracy, three assays by scorification and three by the pot method should be made. It is stated that if proper care be employed, the results agree very well.—A. S.

Iron, Cast-, and Steel; Determination of Carbon in. Rozycki. Rev. univ. des Mines, Dec. 1898, 300; Proc. Inst. Civil Eng. 1899, 64.

The author states that the carbon may be determined in cast iron and steel in less than an hour, and in more refractory alloys, such as ferro-chromium, in about two hours, by a method of direct combustion, without previous removal of the iron by solution in metallic chlorides, as is usually done. 0·25 grm. for ferro-chromium or 2—3 grms. for steel, of very fine shavings, is intimately mixed with 20 grms. of pure alumina. The mixture is placed in a porcelain boat (160 mm. by 25 mm.) in a porcelain tube connected on one side to a short tube of hard glass containing cupric oxide, and to an absorption apparatus for the carbon dioxide, and on the other side to a tube supplying pure dry oxygen. The combustion is proceeded with in the usual manner, the tube containing cupric oxide being first rapidly heated, and then the part of the main tube containing the assay brought to a bright red heat, a constant flow of oxygen being maintained for a period varying with the nature of the metal from 35 minutes to 1½ hours.
—A. S.

Zinc, Volumetric Determination of. Pouget. Comptes Rend. **129**, [1], 45—47.

Sodium acetate is added to the zinc solution and subsequently ammonia until a permanent precipitate is formed. Solution of hydrogen sulphide is then added, in amount more than sufficient to precipitate the zinc, and the solution is boiled till every trace of hydrogen sulphide has disappeared. To the cooled liquid is added a known amount of standard iodine solution, and the excess of iodine is determined by standard thiosulphate solution with starch. The author claims that the method is sufficiently accurate and very rapid, as the filtration of the zinc sulphide is avoided altogether, and the boiling can be carried out with no attention on the part of the operator.—J. T. D.

Water, Estimation of the Hardness of. L. Vignon and L. Meunier. Rev. Gén. des Mat. Col. 1899, **3**, [31], 240—243.

Determination of the Free and Semi-Free Carbonic Acid.—The following standard solutions are prepared :—A saturated solution of lime (saturated at 15° C., a solution of lime contains 1·8 grm. of calcium hydrate per litre); alcohol of 93°, and a solution of 5 grms. of phenolphthaleïn in 100 c.c. of the latter. With these a type solution is made by placing in a 100-c.c. stoppered glass cylinder, 50 c.c. of distilled water, previously boiled in a nickel vessel and cooled, the same volume of the alcohol, boiled immediately before in a glass flask and cooled, 10 drops of the phenolphthaleïn solution, and 1 c.c. of the lime solution. The determination of the carbon dioxide, which is present in the free state and in combination with the carbonates of calcium, magnesium, &c., in the water to be examined, is effected by introducing into a vessel similar to that which contains the type solution, 50 c.c. of the water, with the quantities of alcohol and phenolphthaleïn taken for the type solution, and adding the lime solution until the mixed solution has the same tint as the type. Assuming that $n + 1$ c.c. of the standard solution are required to accomplish this result, then, deducting the c.c. employed in colouring the type solution, the number of c.c. of carbon dioxide present in a litre of the water is $\frac{n \times 1\cdot8 \times 22 \times 1{,}000}{50 \times 37 \times 1\cdot9774}$, or 10·8 n, to combine with which, 2·5 grms. of lime (CaO) are required per 1,000 c.c.

Estimation of the Amount of Sodium Carbonate required to decompose the Sulphates and Chlorides of Calcium, Magnesium, &c.—For this, alcohol and an alcoholic solution of phenolphthaleïn of the strength given above, and a solution of 1 grm. of sodium carbonate in a litre of boiled, distilled water, are used. 50 c.c. of the water to be tested are boiled for a few minutes and cooled, the amount lost by evaporation being replaced by distilled water. 50 c.c. of the alcohol and 10 drops of the phenolphthaleïn solution are added, and then the sodium carbonate solution is run in until the liquid has a colour identical with that of one obtained by mixing 50 c.c. of the standard alcohol, 50 c.c. of distilled water, 10 drops of phenolphthaleïn solution, and 3 c.c. of the sodium carbonate solution. From this, the amount of sodium carbonate required to soften the water is calculated. Representing by n the number of c.c. required in the test, less the 3 c.c. used in colouring the type solution, 20 n grms. are required per cubic metre of the water.

In practice, owing to different conditions of temperature, duration of treatment, &c., slightly smaller quantities of the softening agents than those obtained as above described, are usually found to be sufficient.

50 c.c. of the softened water should not give any coloration when mixed with a few drops of phenolphthaleïn solution and boiled.—E. B.

ORGANIC CHEMISTRY.—QUALITATIVE.

Metaphenylenediamine and Paraphenylenediamine Hydrochlorides, Colour Reaction for. L. Cuniasse. Ann. Chim. anal. appl. **4**, 156—157; Chem. Centr. 1899, **1**, [26], 1297.

If to an aqueous solution of metaphenylenediamine hydrochloride, a few drops of a 1 per cent. solution of acetaldehyde in 50 per cent. alcohol, acidified with acetic acid, be added, the mixture be warmed, and then allowed to cool, a magnificent yellow coloration with strong green fluorescence is formed. Paraphenylenediamine hydrochloride, when submitted to the same treatment, gives an orange-red coloration without a trace of fluorescence.—A. S.

Cotton-Seed Oil, Halphen's Reaction for the Detection of. P. Soltsien. Zeits. öffentl. Chem. **5**, 135—136; Chem. Centr. 1899, **1**, [26], 1297.

In continuation of his former experiments (this Journal, 1899, 611), the author confirms the statement of Holde and Pelgry (this Journal, 1899, 711) that cotton-seed oil after heating to 250° C. no longer gives Halphen's reaction. He believes, however, that oil heated in this manner, is no longer serviceable as a food material. Cotton-seed oil heated to 200° C. still gives the reaction. The reaction is most intense after ¾—1 hour's warming on the water-bath.
—A. S.

Flour, The Examination of. H. Kraemer. J. Amer. Chem. Soc. 1899, **21**, 650—663.

The first step is to determine the grade of the flour, for which the author carries out the following tests :—(1.) The dry or wet colour test. In the dry method the samples are arranged side by side, preferably on a colourless glass plate, so that the colour effect may be varied by placing it upon either a dark or a light surface; in the wet method, the plate with the samples is immersed in distilled water at a temperature not exceeding 35° C., and in about an hour the samples develop a more or less pronounced dark colour, according to the grades represented. (2.) The doughing test gives fairly characteristic results. 14 or 15 grms. of the flour are mixed with 10 c.c. of water at the ordinary temperature. In the better grade flours a light elastic dough is obtained, the lower grades giving a more compact dough. (3.) The gluten test consists in washing the starch from the dough with water, and examining under the microscope the glutinous mass remaining. The better grades of flour give an almost transparent delicate fibrous mass, in which numerous starch granules are embedded, there being only few hairs of the beard of the wheat grain and none of the fragments of the pericarp or coat of the grain, which in the poorer flours increase as the quality falls. (4.) The baking test, in which the following data are considered: weight of flour used, amount of water, yeast, and salt, temperature and time of baking, size and weight of the finished loaf, and its appearance on cutting. (5.) Paste test. If 1 grm. of flour be well mixed with 15 c.c. of water, and gradually heated to boiling, with constant stirring, and allowed to boil for a minute, it is found that the higher grades give, on cooling, a smooth paste which scarcely flows at all, whilst the lower grades give a more liquid paste of a more or less granular consistency. (6.) Odour test. 1 grm. of flour is heated to boiling for a few minutes with 10—15 c.c. of nearly anhydrous glycerin; if corn-meal be present, even to so small an extent as 5 per cent., an odour like that of popped corn is evolved. (7.) To a practised hand the feel of a flour is characteristic of its quality.

For the sake of comparison, a microchemical study of the changes produced in the grains of wheat and corn starch by the action of a large number of reagents was carried out, the detailed results being given. From these results it is concluded that there are at least two different kinds of starch grains in each class. The wheat starch grains are either (1) nearly spherical or elliptical in outline, with no prominent point of growth, or (2) characterised by a many-sided fissure; the corn-starch grains are either (1) four- to six-angled, with a pronounced lenticular or star-shaped fissure, or (2) nearly spherical, with a more or less circular point of growth.

The author bases his system of classification of commercial flour on the dough test, the paste test, and the odour test.

—T. H. P.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Sulphur, Total, in Coal; Estimation of. U. Antony and A. Lucchesi. Gazz. chim. ital. 1899, [29], **1**, 181; from Chem. Zeit. Rep. 1899, **33**, 175.

1 Grm. of the coal is intimately mixed with 4 grms. of MnO_2, 1 grm. of $KMnO_4$, and 2 grms. of dry Na_2CO_3. The mixture, in a platinum crucible covered with a thin layer of the oxidation mixture, is first heated gently for half an hour, and then to bright redness. The combustible substances are completely burnt, and all sulphur, free and combined, is converted into sodium sulphate. When cold, the mass is dissolved in 40—50 c.c. of water; the solution is acidified, filtered, and the sulphuric acid is estimated with $BaCl_2$.—S. K.

Aniline, Volumetric Method of Estimating. M. François. J. Pharm. Chim. 1899, **9**, [11], 521—524.

The method is based on the conversion of aniline into tribromaniline according to the equation—

$$C_6H_5NH_2 + 6Br = C_6H_2Br_3NH_2 + 3HBr,$$

indigotin disulphonic acid, which is not attacked until the aniline has been acted upon, being used to indicate the completion of the reaction.

A solution of about 5 grms. of bromine per litre is employed, and is conveniently standardised by means of aniline hydrochloride. On account of the loss of the element, which occurs on exposing a solution of bromine to air, the burette used should be large enough to hold the volume necessary for several determinations, and should be closed with a plug of pressed cotton-wool. The operation of standardising the solution is performed as follows:—A rough test is made by putting 10 c.c. of the aniline hydrochloride solution (1·392 grms. per litre), along with two drops of indigo-carmine solution, into a narrow-necked flask, and gradually adding the bromine solution until the blue colour is destroyed. A more exact test is then made with the same volume of aniline hydrochloride solution, almost the whole quantity of reagent found by the preliminary test to be necessary being rapidly introduced, with as little exposure to air as possible, then two drops of the indigo-carmine solution, and, finally, the remaining quantity of the solution requisite for the decolorisation of the mixture being added.

The amount of aniline in the volume of solution taken for an estimation should be about 0·01 grm. If ammonia be present along with the aniline, the mixture must be neutralised or acidified with hydrochloric acid before titration.

The following result illustrates the accuracy of the method:—Quantity of aniline taken = 0·01 grm.; bromine required (11·6 c.c. of a solution containing 0·00435 grm. per c.c.) = 0·05046 grm.; bromine theoretically required, 0·05162 grm.—E. B.

Aniline, Volumetric Estimation of, by means of Bromine. G. Denigès. J. Pharm. Chim. 1899, **10**, [2], 63—66.

The author points out that the method of estimating aniline, which was recently published by François (see previous abstract), has been described by him in a thesis presented to the Faculté des Sciences of Paris in 1891, and again in his work, "Précis de Chimie Analytique," published in 1897.

The method given therein is as follows:—A solution containing per litre 15·5 $\left(= \frac{93}{6}\right)$ grms. of aniline and 50 c.c. of hydrochloric acid solution, is used to standardise the bromine solution. 10 c.c. of it are placed in a flask along with 1 c.c. of hydrochloric acid solution, and to this the bromine solution is added until a permanent pale yellow coloration is produced. If *a* c.c. of the latter solution be required, the amount of bromine in a litre of it is $\frac{800}{a}$ grms. The aniline to be tested is dissolved in water, and the solution is acidified with hydrochloric acid. A small quantity of this is taken and titrated with the bromine solution, the end of the reaction being shown by the formation of a permanent, yellow coloration, due to the presence of bromine in excess. No indicator is required.

The standard solutions of aniline and bromine may be employed for an estimation of formaldehyde, based on the precipitation of the latter as anhydroformaldehyde-aniline. A small amount of the solution of formaldehyde is added to a measured volume of a standard solution of aniline hydrochloride in excess; the mixture is then filtered, and the excess of aniline is determined in the manner described.

—E. B.

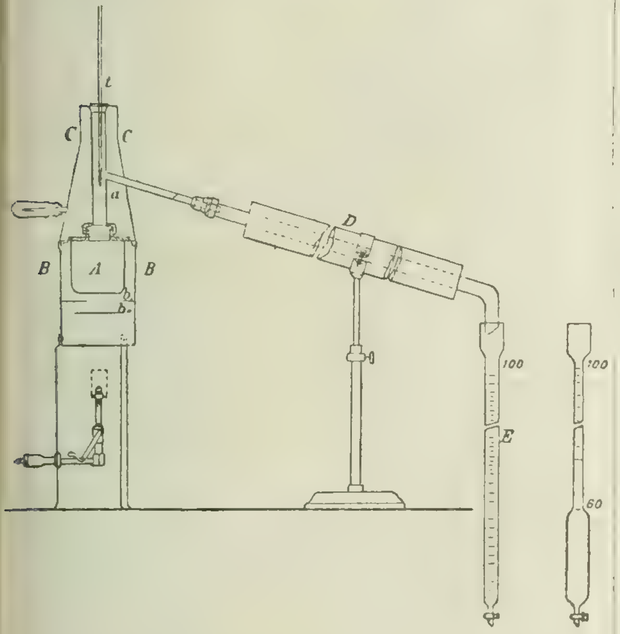
Mineral Oils and Ceresin, The New (German) Customs Regulations for Testing. D. Holde. Mitth. k. tech. Versuchsanst. Berlin, **17**, [1 and 2], 35—43.

1. *Estimation of Paraffin in Crude Petroleum.*—The regulations prescribe that the residue from the distillation of 100 grms. of substance at 300° C. shall be further distilled until completely coked, the second distillate being caught in a separate receiver and examined for paraffin by the Holde method (this Journal, 1897, 362), except that the oil is to be weighed instead of measured. The results are referred to the original weight of substance taken, and if amounting to over 8 per cent., the oil is to be classed as lubricating oil.

The author, with L. Allen, found that, as regards reliability of results, the method is fairly good. They also strove to ascertain what loss of paraffin, if any, occurs through rejecting the distillates boiling below 300° C., and whether the presence of added paraffins is correctly revealed. It was found that a slight quantity of paraffin is removed in the rejected fractions, which they therefore advise should be examined in the case of oils rich in paraffin. Additions of 1 to 3 per cent. of paraffin to Russian crude were almost completely recovered, but with larger proportions (*e.g.*, 5 per cent.), a loss of 0·8—1 per cent. was experienced, about one-half of this loss being due to decomposition in the course of distillation, and the remainder to the solubility of the paraffin in alcohol-ether. The proportion of paraffin found in the fractions below 300° C. in this instance was 0·3—0·5 per cent.

2. *Determining the Boiling-Point Limits of Mineral Oils.*—The apparatus prescribed in the regulations is dis-

played in the accompanying drawing. A is a nickel-plated metal vessel for the reception of 100 c.c. of oil, and is attached to a neck, *a*, containing a thermometer, *t*, graduated to 360° C. and placed so that when in the position shown, the zero point is flush with the top of *a*. The branch tube from the latter is connected with a nickel-plated metal Liebig condenser, D, discharging into the measuring burette, E, of which there are two sizes, 60 c.c. and 100 c.c., graduated in $\frac{1}{10}$. A and its appendage *a* are enclosed in a metal jacket, B, provided with two metal bottoms, *b′ b″*, and a hood, C C; and a Bunsen burner is mounted adjustably on the tripod supports of B.



a. Testing Light Mineral Oils (Petroleum Spirit).—The vessel A is charged with 100 c.c. of the oil to be tested, measured at room temperature (with a margin of 5° C.), the measuring flask being inverted to drain for five minutes into A. The parts are then connected up, and the free space at the top of the burette, E, packed with cotton-wool to prevent evaporation.

Distillation is then commenced by fixing the Bunsen burner in its lowest position, so that the tip of the flame nearly touches the lowest bottom of the jacket B, and as soon as the distillate begins to come over (or in any case at 120° C.), the heat is regulated so that the temperature rises about 1° C. every 15 seconds. At 149° C. the flame is extinguished, and when the thermometer indicates 150° C., the cover C C is removed to prevent a further rise in temperature. If necessary, the neck *a* may be cooled by blowing on it near the branch. When the volume of distillate in the burette amounts to 90 per cent. (vol.) the oil is classed as light oil (spirit).

b. Examination of Crude Oil for Fractions between 150° *and* 320° C.—Proceeding as before up to 150° C., the temperature is then allowed to recede about 30° C., after which a fresh receiver is put into position, and heating is recommenced so as to cause the temperature to rise 2° C. every 12—15 seconds. The condenser water is turned off at 200° C. (or at 150° C. for very thick oil), and at $319\frac{2}{3}$° C. the flame is extinguished and the cover C removed, care being taken to prevent the temperature exceeding 320° C. If the distillate obtained amount to below 40 per cent. of the original oil, the latter is classed as lubricating oil. Averages are taken as under *a*. In measuring very thick oils the flask is marked at 104 c.c. and the oil is measured at 60° C. (having been previously warmed to 70° C.), the margin of 4 per cent. corresponding to the allowance for expansion of 100 c.c.

c. Testing Lubricating Oils.—Oils not classed as crude or light are treated as under *b*, except that there is no stoppage or change of receiver at 150° C., and that 300° C. is the highest temperature employed. If no distillate comes over, or the volume is below 79 per cent. from an oil of above 0·830 sp. gr., the sample is considered as lubricating oil; otherwise it is classed as burning oil.

3. *Examination of Petroleum Residues.*—The regulations state that all dark residues that exhibit a higher specific gravity than water at 15° C., and refuse to flow through the Engler viscosimeter after being warmed $\frac{1}{4}$ hour at 45° C., shall be duty free; but the author points out that this latter condition is likely to give rise to differences of opinion, since some of these residues may escape very gradually from the jet of the tester, *e.g.*, one drop at 2—3-minute intervals, or even longer; and he therefore considers it advisable to fix a definite permissible number of drops per 15 minutes (the duration of the test).—C. S.

Molasses, Exact Determination of the Ash of. V. Zamaron. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **16**, [10], 967—968.

On incinerating molasses, if the carbonaceous mass is heated too strongly at first, an ash is obtained of irregular appearance, for a great part of the mineral salts is decomposed by the action of the sulphuric acid on the bases in the presence of carbon, a partial formation of sulphides being the result. Under these conditions, the platinum capsule is partially attacked, with formation of platinum sulphide.

In consequence of this action, the ash is not sulphated completely, and very sensible errors result.

It is found that if the molasses, after adding sulphuric acid, be heated at first to a temperature not exceeding 400° C. in the muffle, until about two-thirds of the total incineration is effected, and then the substance obtained be heated more strongly, to cherry-red, it calcines well, and does not give rise to the formation of sulphides and decomposition of the salts.

Ten samples of the same molasses, heated directly, give figures varying from 7·86 to 8·93, while on heating as above described, the whole of the tests gave identical figures, 9·07.

Another method of obtaining an ash perfectly incinerated, is to place in front of the muffle a capsule containing sulphuric acid to produce an atmosphere of sulphuric vapours during the incineration.—L. J. de W.

Alcohol and Ether in the Presence of Petroleum Spirit, The Estimation of. H. D. Richmond. Analyst, 1899, **24**, 201—202.

When a mixture of alcohol, ether, and petroleum spirit is shaken with water saturated with ether, the decrease in volume represents the difference between the alcohol removed from the mixture and the ether extracted by it from the water. On shaking a second time with water saturated with ether, the petroleum spirit dissolves the same quantity of ether as before. Thus, the volume of alcohol in the mixture may be calculated. To estimate the petroleum spirit, place 10 c.c. of the original mixture, or of the ethereal mixture left after the extraction of alcohol, in a burette, add a well-cooled mixture of equal volumes of sulphuric and acetic (glacial) acids a little at a time, shaking well between each addition and cooling. The layer separating is petroleum spirit. The ether is found by difference. The results quoted are satisfactory. The method was devised in order to find a process for treating laboratory residues. Petroleum spirit may be recovered from these by adding sulphuric acid little by little, with shaking and cooling. The acid liquid may be used for the regeneration of ether.—A. C. W.

Wood Naphthas, The Examination of. Government Laboratory, London.

The wood naphtha must be sufficiently impure to impart to the methylated spirits, prepared by mixing one part of the wood naphtha with nine parts of spirits of wine, such an amount of nauseousness as will, in the opinion of the

Principal of the Government Laboratory, render such mixture incapable of being used as a beverage, or of being mixed with potable spirits of any kind without rendering them unfit for human consumption.

Wood naphtha submitted for approval should conform to the following tests:—

(*a.*) Not more than 30 c.c. of the naphtha should be required to decolorise a solution containing 0·5 grm. of bromine.

(*b.*) The naphtha, which must be neutral or only slightly alkaline to litmus, should require at least 5 c.c. of decinormal acid to neutralise 25 c.c. of the spirit when methyl orange is used as the indicator.

It should contain:—

(*a.*) Not less than 72 per cent. by volume of methyl alcohol.

(*b.*) Not more than 12 grms. per 100 c.c. of acetone, aldehydes, and higher ketones, estimated as "acetone" by the formation of iodoform according to Messinger's method.

(*c.*) Not more than 3 grms. per 100 c.c. of esters, estimated as methyl acetate by hydrolysis.

The following details of the manner in which the above tests are conducted in the Government Laboratory are published for the information of the trade:—

Bromine Decolorisation.—A standard bromine solution is made by dissolving 12·406 grms. of potassium bromide and 3·481 grms. of potassium bromate in a litre of recently boiled distilled water.

50 c.c. of this standard solution (= 0·5 grm. bromine) are placed in a flask of about 200 c.c. capacity, having a well-ground stopper. To this is added 10 c.c. of dilute sulphuric acid (1 in 4) and the whole shaken gently. After standing for a few minutes, the wood naphtha is slowly run from a burette into the clear brown solution of bromine until the latter is completely decolorised. Not more than 30 c.c. of the wood naphtha should be required for this purpose.

Methyl Orange Alkalinity Test.—The naphtha should be faintly acid to phenolphthaleïn, slightly alkaline or neutral, rarely acid, to litmus, and always alkaline to methyl orange. 25 c.c. of the wood naphtha are placed in each of two beakers, and titrated with decinormal acid, using in the one case a few drops of litmus solution, and in the other of a solution of methyl orange as indicator. With litmus usually 0·1 to 0·2 c.c. of decinormal acid is required to neutralise. With methyl orange the total alkalinity should be greater —at least 5 or 6 c.c. of decinormal acid being required for neutralisation.

The total alkalinity, less that given with litmus, is the "methyl orange alkalinity," and, for the 25 c.c. of wood spirit, should not be less than is required to neutralise 5 c.c. of decinormal acid.

Estimation of Methyl Alcohol.—22 grms. of coarsely powdered iodine and 5 c.c. of distilled water are placed in a small flask and cooled by immersion in ice-cold water. Then 5 c.c. of the wood spirit (60·0 o.p.) are added, the flask corked, the contents gently shaken, and allowed to remain in the ice-cold bath for 10—15 minutes.

When well cooled, 2 grms. of red phosphorus are added to the mixture of spirit and iodine in the flask, and the latter is immediately attached to a reflux condenser.

The reaction soon commences, and must be moderated by dipping the flask into a cold water bath. (Spirit may be lost if the reaction be too violent.) After about 15—20 mins., when all action appears to have ceased, the water bath under the flask is gradually heated to a temperature of about 75° C. (167° F.), and the flask, being occasionally shaken, is allowed to remain at this temperature for 15—20 mins. The source of heat is then removed and the apparatus left for an hour till it has cooled, when the condenser is reversed, and the methyl iodide slowly distilled off—first at a low temperature—the bath being allowed to boil towards the end of the operation only. The end of the condenser dips into water in a measuring tube, and the iodide is collected under water and measured at a temperature of 15·5° C. (60° F.).

The percentage (by volume) is found from the formula:—

$$\frac{\text{c.c. methyl iodide found} \times 0{\cdot}647 \times 100}{\text{c.c. wood spirit taken.}} = \text{Percentage (by volume) of methyl alcohol.}$$

Or, when 5 c.c. of spirit are taken: c.c. methyl iodide × 12·94 = percentage (by volume).

Esters, acetals, &c., also yield methyl iodide by this process, and from the percentage of methyl alcohol calculated as above, an amount equivalent to the percentage of these substances present must be deducted. Practically, however, methyl acetate is the only compound usually found in quantity sufficient to materially affect the result. The grms. of methyl acetate per 100 c.c. of spirit, multiplied by 0·5105, give the equivalent of methyl alcohol to be deducted from the total percentage by volume calculated from the methyl iodide found.

The Acetone Reaction.—25 c.c. of normal soda are placed in a flask similar to those used in the bromine reaction. To this is added 0·5 c.c. of the naphtha. The mixture is well shaken, and allowed to stand 5—10 minutes. Into it, from a burette, N/5 iodine solution is run slowly, drop by drop, vigorously shaking all the time till the upper portion of the solution, on standing a minute, becomes quite clear. A few c.c. more of N/5 iodine solution are added, since to get concordant results an excess of at least 25 per cent. of the iodine required must be added. After shaking, the mixture is allowed to stand for 10—15 minutes, and then 25 c.c. of normal sulphuric are added. The excess of iodine liberated, is titrated with N/10 sodium thiosulphate solution and starch, and half the number of c.c. of thiosulphate solution used, are deducted from the total number of c.c. of iodine solution used. The difference gives the amount of acetone by weight in the naphtha by the formula: c.c. N/5 iodine solution required, × 0·3876 = grms. of acetone per 100 c.c. of wood naphtha.

This includes as acetone any aldehydes, &c., capable of yielding iodoform by this reaction.

If the quantity of "acetone" be excessive, a less quantity of the spirit is taken, or 10 c.c. are diluted with 10 c.c. of methyl alcohol free from acetone, and 0·5 c.c. of the mixture is used.

Estimation of Esters.—5 c.c. of the wood naphtha are run into a silver pressure flask of about 150 c.c. capacity together with 20 c.c. of recently boiled distilled water. 10 c.c. of normal soda solution are added, the flask securely closed, and digested for at least two hours in a water-bath at 100° C. (212° F.). The contents are then washed into a beaker, and titrated with normal acid and phenolphthaleïn. The difference between the number of c.c. of soda taken and of the acid required for neutralisation may be calculated as methyl acetate (weight in volume) from the formula:—

$$\frac{0{\cdot}074 \times \text{c.c. soda required} \times 100}{\text{c.c. naphtha taken}} = \text{grms. per 100 c.c.}$$

Or, if 5 c.c. of spirit be taken as above: 1·48 × c.c. soda required = grms. of methyl acetate per 100 c.c. of spirit.

"*Saccharin,*" *Valuation of.* E. Emmet Reid. Amer. Chem. J. **21**, [6], 461.

o-Benzoyl sulphonic imide, when boiled with dilute acids, passes through *o*-sulphamine benzoic acid into the acid ammonium salt of *o*-sulphobenzoic acid, whilst *p*-sulphamine benzoic acid is not affected (Remsen and Burton, this Journal, 1890, 100). In his work on the hydrolysis of acid amides, the author estimated the amount of amide decomposed by the amount of ammonia it would yield. It was natural to attempt the estimation of saccharin in the same way. Hefelmann has already suggested the use of 71 per cent. sulphuric acid for this purpose, and a number of analyses of commercial "saccharins" and of pure sulphonic imide, also of pure *p*-sulphamine benzoic acid to check Hefelmann's method, were made, the results of which led the author to return to hydrochloric acid.

0·650 grm. of "saccharin" is weighed out into a 100-c.c. flask, and 50 c.c. of dilute hydrochloric acid are added (120 c.c. pure concentrated HCl in 1 litre). The flask is fitted with a cork, through which a glass tube passes, 8 mm. wide and 45 cm. long. After two hours' gentle boiling on a sand-bath, the stopper is removed, and the solution allowed to evaporate to about 10 c.c. After diluting, the contents are washed out into an ordinary distilling flask. 20 c.c. of a caustic solution (equal to 10 grms. of NaOH) are added, the ammonia is distilled off into standard acid, and the excess titrated back with KOH, cochineal being the indicator. To cause the caustic soda solutions to boil evenly, steam is passed into the distilling flask from another flask containing water, a little potassium bichromate and sulphuric acid. The results by this method are more satisfactory, as HCl does not act on the *p*-sulphaminebenzoic acid at all, whilst 71 per cent. sulphuric acid does to some extent.

Since "saccharin" has been found not to yield any ammonia on boiling with caustic soda, the estimation, as above described, does not lack accuracy through the presence of ammonium salts, or of other volatile bases, or of benzamide, or any substances that are decomposed by boiling with 10 or 15 per cent. caustic soda.—S. K.

"Saccharin" in Wines, Detection of. D. Vitali. Boll. Chim. Farm. **38**, 297—300. Chem. Centr. 1899, **1**, [26], 1297.

Bornträger has already shown that the method given by Remsen (Amer. Chem. J., **9**, 392) for the detection of saccharin in wine, is of no value, as not only substances normally present in wine, such as tartaric acid, citric acid, &c., but resorcinol alone give, under certain conditions, with sulphuric acid, the green fluorescence. The author considers that the Allen-Reischauer reaction (Deutsch. Zucker Ind., **11**, 123)—detection of saccharin based on the estimation as sulphate of the sulphur contained in that substance—is alone capable of detecting small quantities of saccharin.

Small quantities of saccharin may be determined by treating the residue from the evaporation of the wine, with mercuric nitrate, and drying and weighing the mercury saccharinate, $(C_6H_4:COSO_2:N)_2Hg$, which is formed and decomposing it with sulphuretted hydrogen; the quantity of saccharin in the sample is found from the difference in weight of the mercury sulphide and the mercury saccharinate.—A. S.

Wine, Beer, and Cider, Sulphurous Acid in; Rapid Method for Detection and Determination of. M. Guerin. L'Union Pharm. **40**, 289—290.

Qualitative Test.—About 10 c.c. of the liquid are introduced into a small flask, fitted with a cork bearing a pointed delivery tube, acidulated with a few drops of H_2SO_4 free from SO_2 and boiled. When boiling, a test paper moistened with a solution of 0·10 grm. of potassium iodate, 2 or 3 c.c. of 5 per cent. starch solution, and 10 drops of H_2SO_4, is applied to the point of the jet. If the original liquid contain even less than 0·01 grm. of SO_2 per litre, the test paper will show a blue colour.

Quantitative Determination.—A standard solution of H_2O_2 is prepared by diluting 14·6 c.c. of that reagent (standardised to 12 volumes of available oxygen) to 1,000 c.c. with distilled water, slightly acidified with H_2SO_4. A rough determination is first made by measuring quantities of 10 c.c. of the liquid into a series of test glasses, adding 1 c.c. of the standard H_2O_2 solution to the first, 2 c.c. to the second, and so on. The contents of each glass is then tested with the starch test paper; the number of c.c. of the standard solution in that in which the blue coloration is no longer given, is noted.

The original liquid is thus found to contain less than 0·1 grm. of SO_2 per litre × this number. For example, if the reaction be no longer given by the glass containing 3 c.c. of the standard solution, the amount will lie between 0·2 and 0·3 grm. SO_2 per litre. A more precise test is now made, by adding, first, 2 c.c., then 2·1 c.c., 2·2 c.c., and so on, to a fresh series of the original solution which are tested as before; if then the colour reaction disappears between the solutions containing 2·2 and 2·3 c.c. of the standard H_2O_2 solution, the original liquid will contain between 0·22 and 0·23 grm. per litre of SO_2.—J. O. B.

Milk, New and Accurate Method for the Estimation of Fat in. A. A. Bonnema. Chem. Zeit. 1899, **23**, [51], 541.

A mixture of 10 c.c. of milk and 1·5 c.c. of caustic potash (20 grms. of KOH in 100 c.c.) is shaken up for a moment in a bottle of 100 c.c. capacity; 25 c.c. of ether are added and the bottle now well shaken for about five minutes. It may happen that the contents will gelatinise. In any case, the bottle is placed for some time in cold water. 2 grms. of gum tragacanth are quickly added and the bottle is again shaken. The tragacanth absorbs all the water and becomes conglomerated, whilst the ether, being freed from water, becomes clear. The bottle is once more placed in cold water. 10 c.c. of the clear ether-solution are then poured into a small narrow graduated tube. The ether is then transferred to a weighed dry glass basin, previously balanced, and the tube is washed with a little pure ether. The solvent is evaporated at a gentle heat and the residue (fat) dried until the weight is constant.

Since 10 c.c. only of the original 25 c.c. of ether have thus been used, the weighed quantity of fat corresponds to 4 c.c. of the milk.

It is essential, that when shaking with ether, the bottle should be kept in the warm hand in order to keep the butterfat melted, so as to render it more easily soluble.—S. K.

Cinchona Analysis, Acetic Acid as a Menstruum in. E. R. Squibb. From the "*Ephemeris*," U.S.A. Chem. and Druggist, Aug. 26, 1899, 360.

The author has made a number of experiments with acetic acid as a menstruum, the object being to avoid the use of duty-paid spirit, and to obtain liquid extracts or other preparations equal in efficiency to those made with alcohol. The re-percolation process was employed. A 10 per cent. acetic acid was employed, the results obtained in the case of nux vomica being better than those obtained with alcohol, whilst with cinchona, the results were quite as good as those obtained with the U.S.P. menstruum, consisting of 4 vols. of 91 per cent. alcohol and 1 vol. of glycerin. Acetic acid was also found to give satisfactory results in analysis, the method, in the case of cinchona, being as follows:—10 dr. of powdered cinchona are macerated with 10 per cent. acetic acid, until 180—200 c.c. of percolate are obtained (36 hours). The percolate evaporated to the condition of a soft solid, is heated on a water-bath with 30 c.c. of a mixture of 1 vol. of 10 per cent. ammonia and 3 vols. of 10 per cent. alcohol, the mixture, when uniform, poured into a separator, and 10 c.c. more of the ammonia mixture, with 10 c.c. of alcohol added, or sufficient ammonia to completely neutralise the acetic acid and set the alkaloids free. The mixture is then extracted with chloroform in the usual way, and the alkaloidal residue from the evaporated extract, is titrated with decinormal alkali as a check on the weighing.

The author recommends the following as a rapid method for the approximate determination of the amount of alkaloids in a cinchona preparation:—10 c.c. of the liquid preparation of the cinchona is well mixed first with 20 c.c. of the ammonia-alcohol mixture, and then with 30—40 c.c. of chloroform. The liquids are separated, and then the usual method followed up to the point of dissolving the chloroform extract in a fresh portion of chloroform. If the chloroform extract be less than 1 grm., 10 c.c. of fresh chloroform is sufficient for its solution in the flask, and to this is added 10 c.c. of decinormal acid. The flask is vigorously shaken, 10 c.c. of water added, again shaken, and the contents poured into a separator. The chloroform is drawn off, well shaken with 2 c.c. of decinormal acid, the mixture agitated with 5 c.c. of water and transferred to a separator, and the flask rinsed into the same. The chloroform is drawn off, and the aqueous acid solution mixed with that obtained previously. The chloroform should be "bitter-free"; if not, the washing must be repeated. The combined aqueous liquids are titrated with decinormal alkali.—A. S.

Alkaloids, New Method for the Acidimetric Titration of. E. Falières. Comptes Rend. **129**, [2], 110—111.

A solution of about 10 grms. of copper sulphate in half a litre of water is precipitated by ammonia, the precipitant being added in excess till the precipitate is just redissolved; the solution is then made up to a litre with water, filtered, and titrated against decinormal sulphuric acid, the first appearance of a permanent turbidity when the copper solution is added to the acid, being the indication of the end of the reaction.

The alkaloid to be determined (0·1 grm.), is dissolved in a narrow cylinder in 20 c.c. of decinormal acid, the cylinder placed on a black ground, and the free acid determined by the copper solution. The difference between this amount and the 20 c.c. originally taken, is, of course, the amount used in the solution of the alkaloid. The advantage of the method is that coloured solutions can be tested as easily as those which are colourless.

The author has found that the method gives satisfactory results with a number of different alkaloids.—J. T. D.

Veratrine, The Analysis of Commercial. G. B. Frankforter and L. B. Pease. Amer. Journ. Pharm. 1899, **71**, 130—133; through Analyst, 1899, **24**, 209—210.

The commercial products known as "veratrine" show a great variation, this is to be attributed to the difficulty with which the *veratrum* alkaloids crystallise and to the fact that several of these alkaloids have been known as veratrine. The authors have found cevadine, $C_{32}H_{49}NO_{9}$, to be the chief constituent of the commercial veratrines examined, and in no case was more than a trace of the other alkaloids found. The samples contained a small quantity (0·86—3·89 per cent.) of an amorphous powder, insoluble in ether, which melted at 184°—285° C.—A. C. W.

Cantharidin, Determination of. Gehe. Pharm. Central. **40**, 230.

Twenty-five grms. of cantharides are macerated for 24 hours with 100 c.c. of chloroform and 2 c.c. of HCl, with occasional agitation. The mixture is then filtered on a covered filter, 62 c.c. of the filtrate are taken, and the solvent evaporated. The residue is treated with 5 c.c. of petroleum ether, and thrown upon a small tared filter, washed with two successive portions, each of 10 c.c., of petroleum ether, and dried at 60° C. From cantharides of good quality, the weight of cantharidin thus obtained should be not less than 0·12 grm., equivalent to 0·8 per cent.—J. O. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

High Temperatures, Process for the Production of. H. Goldschmidt. Zeits. für Elektrochem. 1899, **6**, [3], 53—57.

In an address to the German Electrochemical Society the author refers to his former address (this Journal, 1898, 584), and points out that several of the applications mentioned (*loc. cit.*; see also this Journal, 1898, 543, 649, and 1151) have now been realised on an industrial scale. Practically the process may be developed in the following three directions:—

1st. In the preparation of pure metals and alloys (free from carbon), *e.g.*, chromium, manganese, manganese-copper alloys containing 50, 30, and 20 per cent. of manganese, chromium-copper alloys, and ferrotitanium and ferroboron containing from 10 to 25 per cent. of titanium or boron.

2nd. In the manufacture of artificial corundum for grinding and polishing purposes.

3rd. In the generation of heat, locally and otherwise, for working metals. The author specially mentions the application of the process to hard soldering, welding, &c. It has been actually employed for welding together the rails on electric railways, thereby making a continuous circuit for the electric current. It is claimed that no bad effects are noticed from the want of play for the contraction and expansion of the rails, and that the continuous rail prevents unpleasant bumping and thereby effects an economy, inasmuch as lighter rolling stock may be employed.

The process has also been employed in repairing defects, which could not be rectified either by means of an ordinary fire or by electric heating, in large pieces of machinery and especially in steel castings.—J. S.

Carbon Bisulphide, Combination of, with Hydrogen and Nitrogen. Berthelot. Comptes Rend. **129**, [3], 133—136.

Mixtures of hydrogen and carbon bisulphide vapour were exposed to the silent discharge of an induction coil at a temperature of about 24° C. and the atmospheric pressure. The E.M.F. of the primary current varied in different experiments from 4·2 to 25 volts. The gases disappeared with formation of a compound $C_{[illegible]}H_{[illegible]}S_{[illegible]}$, which appears to be either a thio-oxalic acid or a persulphide of a thioglyoxal. At the lower voltages, simple polymerisation of carbon bisulphide occurs alongside of the formation of this compound.

With mixtures of carbon bisulphide and nitrogen the volumes of the gases which disappeared varied from 4 vols. of the bisulphide to 1 of nitrogen at an E.M.F of 12·6 to 7 vols. of bisulphide to 1 of nitrogen at an E.M.F. of 25 volts.

In the case of argon and carbon bisulphide, from 24 to 34 vols. of carbon bisulphide disappeared for each volume of argon, the amount of argon decreasing as the E.M.F. was raised, until at 12·6 volts there was no diminution of the volume of argon. The author points out that the proportion of a quantity of oxygen converted into ozone by electricity at the ordinary temperature is of the same order of magnitude as the amount of argon associated with the carbon bisulphide in these experiments.

A mixture of 100 vols. of carbon monoxide and 68 vols. of carbon bisulphide disappeared almost entirely in 10 hours, with an E.M.F. of 6·3 volts. The solid substance produced appears to be for the most part a mixture of the separate condensation products of the monoxide and the bisulphide, though there is evidence of a certain amount of action between the two.—J. T. D.

Nitric Oxide, Action of, on Chromous Salts. G. Chesneau. Comptes Rend. **129**, [2], 100—103.

Solutions of chromous salts absorb nitric oxide in the same way as ferrous salts, yielding a true compound of three molecules of nitric oxide to one molecule of chromous salt. These compounds readily decompose, especially at a high temperature, but without any disengagement of nitric oxide gas. The nitrogen of the nitric oxide forms ammonia or hydroxylamine, while the oxygen forms a chromic oxychloride or similar compound. When the solution of nitric oxide is slow, only about three-fourths of the amount is absorbed which is taken up when it is rapid, owing to the action of the compound formed on the unaltered chromous salt; in this case ammonia, not hydroxylamine, is the product of the decomposition.—J. T. D.

Sodium, Heat of Oxidation of. De Forcrand. Comptes Rend. **128**, [24], 1449—1452.

Betékoff gave for the heat of solution of Na_2O in water, the figure 54·766 cal., which leads to the result 101·134 cal., or 99·034 cal. for the heat of formation of Na_2O from Na, according as Thomsen's or Joannis' figure for the heat of reaction of sodium on water be adopted. The figure in either case is higher than that representing the heat of formation of K_2O from K, and the author has accordingly attempted a redetermination of Betékoff's figure. A mixture of Na_2O and Na_2O_2 in known proportions, gave as a final result the figure 63·865 for the heat of solution of Na_2O, which makes the heat of formation of Na_2O 92·035 or 89·935, as Thomsen's or Joannis' result is used in the calculation. The corresponding figures in the case of potassium are 97·80 and 92·00, so that the new figure for sodium places it below potassium, as it should be.

—J. T. D.

Chrysean from Potassium Cyanide. G. Hellsing. Ber. **32**, [9], 1497—1498.

Wallach prepared chrysean (see Ber. **7**, 902) by the action of hydrogen sulphide on an aqueous solution of potassium cyanide. The author finds that it is formed by the action of thioformamide on potassium cyanide solution, ammonia being evolved at the same time. Probably thioformamide takes up hydrocyanic acid, and two molecules of the nitrile so formed coalesce with evolution of one molecule of ammonia.—J. T. D.

Tin Chloro-iodide and Bromo-iodide. C. Lenormand. J. Pharm. Chim. **10**, [3], 114—117.

By fractional distillation, under ordinary atmospheric pressure, of the tin chloro-iodide, $SnCl_2I_2$, previously isolated by the author, a yellow liquid is obtained between 126° and 180° C.; on further heating to 280° C., the delivery tube becomes filled with reddish-orange crystals. This crystalline body is found to have the composition $SnClI_3$. If the liquid obtained in the above process be again distilled *in vacuo*, the distillate which passes over between 128° and 130° C. is stannic chloride; the residual one-third corresponds to the formula $SnCl_3I$. If distillation be carried further, this residue has the composition of the original substance, $SnCl_2I_2$. The decomposition is thus represented: $5SnCl_2I_2 = SnCl_4 + SnCl_3I + SnCl_2I_2 + SnClI_3 + SnI_4$. If the original body, $SnCl_2I_2$, is distilled at once *in vacuo*, the products of decomposition are much more simple, as shown by the equation, $2SnCl_2I_2 = SnCl_4 + SnI_4$.

Tin Bromo-iodide, $SnBr_2I_2$, is obtained by the action of bromine on stannous iodide in a closed vessel at 100° C. At this temperature it is a fluid, but forms an orange-red crystalline mass of hexagonal crystals at ordinary temperatures. It commences to melt at 50° C. and boils at 225° C.; its density at 15° C. is 3·631. When distilled, it yields between 230°—250° C. the compound $SnBr_3I$, which condenses in the form of orange-yellow crystals. Between 250°—275° C. the original substance, $SnBr_2I_2$, distils over; the residue then consists of an orange-red body, having the composition, $SnBrI_3$. The decomposition of $SnBr_2I_2$, when distilled under ordinary pressure, may be represented as follows: — $3SnBr_2I_2 = SnBr_3I + SnBr_2I_2 + SnBrI_3$. Distilled *in vacuo*, $SnBr_2I_2$ boils at 130° C.; the temperature slowly rises to 180° C.; at this point the distillate has the composition $SnBr_3I$, and the residue is another bromoiodide, $SnBrI_3$.—J. O. B.

Copper Reduced at a Low Temperature. A. Colson. Comptes Rend. **128**, [24], 1458—1460.

Copper reduced at a low temperature from the oxide inflames in bromine vapour, or, when a drop of bromine is brought into contact with it, it induces the combination of unsaturated hydrocarbons with hydrogen, &c. These reactions have been attributed to the copper being in the so-called "nascent state." The author has shown, however, that copper reduced from the oxide below 200° C., whether by hydrogen or by carbon monoxide, whilst possessing these properties, has exactly the same heat of oxidation as ordinary copper in filings or borings. Moreover, by simple agglomeration effected by hammering in a steel mortar, this low-temperature copper loses the power of inflaming in contact with bromine. The greater activity of the metal in the first instance, then, is due simply to its state of fine division, not to its existence in an allotropic or "nascent" condition.—J. T. D.

Ferment, Nitrate-reducing Soluble; Presence of, in the Animal Organism. E. Abelous and E. Gérard. Comptes Rend. **129**, [1], 56—58.

In all the organs of the body, though in very unequal amount, there exists a soluble ferment which is capable of reducing nitrates. It is not an organised body, for an aqueous extract of the various organs, filtered, possesses the reducing power. The reducing substance is destroyed, however, by a temperature of 100° C.—J. T. D.

Benzoic Acid, Note upon the Electrolysis of. C. Schall. Zeits. f. Elektrochem. **6**, 102—103.

The author has proved that with currents of sufficient intensity it is possible to obtain electrolytic decomposition of fused mixtures of benzoic acid and sodium benzoate, with production of benzene ring derivatives at the anode. The aromatic series of organic products are thus brought into line with the aliphatic series, so far as electrolytic decomposition is concerned.—J. B. C. K.

New Books.

Chemisch-Technisches Repertorium. Uebersichtlicher Bericht über die neuesten Erfindungen, Fortschritte und Verbesserungen auf dem Gebiete der technischen und industriellen Chemie, mit Hinweis auf Maschinen, Apparate und Literatur. Herausgegeben von Dr. Emil Jacobsen. 38. Jahrgang. 1899. Erstes Halbjahr. Erste Hälfte. Mit in den Text gedruckten Illustrationen. R. Gaertner's Verlagsbuchhandlung, Hermann Heyfelder, Schöneberger str. 26, Berlin, S.W.

This is the first number of Jacobsen's quarterly "Repertorium" for 1899, and it treats of the following subjects of Applied Chemistry:—Building Materials, Cements, Artificial Stone. Dyestuffs, Dyeing and Calico Printing, Coal-tar Products. Fats, Oils, Illuminating and Heating Materials. Fermented Liquors. Tanning, Leather and Glue Manufacture. Textiles. Glass and Earthenware. Wood and Horn. Indiarubber and Guttapercha, Cements and Adhesives. Lakes, Varnishes and Paints. Metals.

The Mineral Industry: Its Statistics, Technology, and Trade, in the United States and other Countries, to the end of 1898. Edited by Richard P. Rothwell, Editor of the Engineering and Mining Journal, Ex-President American Institute of Mining Engineers, &c., &c. Vol. VII. The Scientific Publishing Company, New York and London. 1899. Price $5.

Large 8vo volume, containing 940 pages, illustrated with 23 engravings, and followed by an alphabetical index of subject-matters and authors together. This volume forms the seventh of the series, the first being published in 1893, and containing the statistics for 1892, &c. Vol. VII. brings the record down to the close of 1898, not merely as regards statistics, but also reviewing technical progress and industrial conditions. The following form the headings of the various chapters, and indicate the nature and grasp of the general subject:—Introduction. Aluminium and Alum. Ammonium and Ammonium Sulphate. Antimony. Arsenic. Asbestos. Asphaltum. Barytes. Bismuth. Borax. Bromine. Calcium Carbide. Carborundum. Cement. Chromium and Chrome Ore. Clay. Coal and Coke. Copper. Felspar. Fluorspar. Fuller's Earth. Garnet. Gems and Precious Stones. Gold and Silver. Graphite. Gypsum. Iron and Steel. Lead. Limestone. Magnesium and Magnesite. Manganese. Mica. Molybdenum. Monazite. Nickel and Cobalt. Ochre and Oxide of Iron Pigments. Petroleum. Phosphate Rock and Phosphorus. Platinum and Iridium. Potash and Potassium. Quicksilver. The Rare Elements. Salt. Silica. Slate. Soda and Sodium. Stone. Sulphur and Pyrites. Talc and Soapstone. Tin. Tungsten. Zinc and Cadmium. Progress in Ore Dressing in 1898. Progress of Metallography in 1898. Mining Stock Exchanges in 1898. Mineral Statistics of Foreign Countries. The United States. The Buyers' Manual. The Professional Directory.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

Bulgaria.

Free Entry of Articles for Use in Native Industries.

Her Majesty's Consul-General at Sofia, transmits a further list of articles which the Bulgarian Government has exempted from import duty, when imported for the use of factories enjoying privileges under the law for the encouragement of native industries, as follows:—

"Sulfuriol," coal, or raw petroleum (solely for the Varna cotton manufactory), vaseline, salts of antimony, sulphate of soda, logwood, acetic acid, benzine, alum, glycerin, sulphate of iron, litharge, potash, castor oil.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

The Formosan Camphor Industry.

Foreign Office Annual Series, No. 2339, *Aug.* 1899.

The camphor trade, that is to say, the manufacture of camphor, for some time past in the hands of German merchants only, has ceased to be of interest to any but Chinese and Japanese, the latter having in every way more facilities for handling this article in the interior. Although from time to time reports are recieved of robbery with violence perpetrated by banditti up-country, most places where camphor is now manufactured can be considered as more or less quiet.

The British Consul at Tamsui states that since it has been decided by the Formosa Government to institute a camphor monopoly, production has materially increased, owing to the high prices ruling in Hong Kong during the last few months.

The monopoly was to come into force on 1st July 1899, and from that date the Government alone will be allowed to purchase camphor from the producers; and as they will only buy a certain quantity per annum, they will have absolute control of the working of camphor, together with all matters respecting the cutting down of trees, &c.

Permits will be issued to producers, and anyone having the proper concession-papers and who has taken out a licence in due form, will be allowed to produce camphor.

The Government will itself undertake the sale of the raw camphor, after production, in its unrefined state, and will dispose of it to purchasers at certain points to be determined upon by the Government. These places will probably be Daitotei (Twatutia), Shinchiku (Tekcham), Tokoham, and the towns on the west coast where camphor has usually hitherto been deposited awaiting transport.

The Government has already fixed the price of camphor for the period from July 1, 1899, to the end of the financial year at 30 yen (say 3*l.*) per 100 catties (say $133\frac{1}{3}$ lb.).

The Consul is of opinion that this price would seem to be too low, and that it will very probably be raised for the following reasons:—

If the Government buys at 30 yen at the places of production, *i.e.*, as it comes out of the stills, this would give the manufacturer only 2 or 3 yen profit, not taking account of possible and probable losses occasioned by typhoons or other causes, whilst if the Government proposes to make its purchases at Daitotei (Twatutia), Shinchiku (Tekcham), and the other places mentioned, 30 yen would be quite insufficient to give a profit after deducting expenses for cost of transport from the stills and loss in weight. This last item alone would amount to at least 10 per cent.

The present monthly export to Hong Kong may be calculated at from 2,000 to 2,500 boxes from Tamsui, and say from 100 to 200 boxes from Kelung to Japan. Owing to the enhanced prices ruling in Hong Kong, in anticipation of the monopoly, the total export from the island has increased by about 600 boxes a month.

Adulteration of Sicilian Oils.

Bd. of Trade J., Sept. 1899, 354.

The U.S. Consul at Messina suggests that all dealers in essential oils who purchase under chemists' certificate, should take a sample in the presence of witnesses immediately upon arrival of the goods, and send it for analysis to a firm of analytical chemists in Messina, whom he mentions. The Consul states that even after a copper of essential oil has been sealed, it can be most successfully tampered with, as, by a minute's contact with a hot iron on the line of solder which encircles the copper, sufficient can be removed to allow two little holes to be made. The copper is then placed on its side, and some of the contents run off, after which the adulterant turpentine is readily injected with a syringe, and a few passes of the soldering-iron destroy all traces of the work. The Consul wishes it to be understood that he has not heard of any exporter adopting this method, but merely how it can be done.

Carriage of Liquid Ammonia on board Ship.

Chem. and Druggist, Aug. 26, 1899, 379.

The Board of Trade has issued the following instructions to surveyors regarding the precautions to be adopted when this liquid is carried as cargo on board ship:—It should only be packed in iron vessels which have been carefully tested up to a pressure of 675 lbs. per square inch, and should be stored in a part of the ship beyond the influence of any heat from boilers or furnaces, and remote from the living quarters. The aqueous solution of ammonia of a sp. gr. of 0·880 at 60° F. should be conveyed in drums of about 12 galls. capacity, with an empty space equal to 5·33 per cent. left in each drum. If for carriage on board ship the drums should be capable of withstanding a pressure of 66 lb. per square inch, and should be packed in cases with not more than four drums in a case, the interstices being filled with sawdust. But for short voyages, such as to Ireland or the Continent, the drums need not be packed in cases. At a temperature above 130° F. the expansion of liquid ammonia is rapid, and a risk of explosion much increased. Care should therefore be taken not to expose drums containing this liquid to the rays of the sun or to the influence of heat from boilers. It should be carried well away from the living-quarters as deck-cargo only, and should not be covered with black tarpaulin. Ammonia solution of a sp. gr. of 0·959 and upwards is exempted from the operation of the above instructions.

Anglo-Swiss Trade.

Foreign Office Misc. Series, No. 509; *through Chem. and Druggist, Aug.* 26, 1899, 366.

A highly interesting and instructive report by Mr. F. R. St. John, British Consul at Berne, on the condition of British trade in Switzerland, has just been published by the Foreign Office. Mr. St. John goes more fully into his subject than is usually the case with consuls, and by means of a series of tables gives readers of all classes details which enable them to see the import of his advice. The report consists of two parts. First, it gives a minute comparison between the British and German imports into Switzerland, which is followed by a more condensed statement and comparison of British and French trade with Switzerland. Both are for 1897, the figures for 1898 not yet being available. In the second part are given suggestions for the development of British trade with Switzerland. As it is rare that an opportunity is presented for ascertaining to what extent we are beaten by Germany in the drug and chemical markets, we have compiled the following table from the reports, showing the imports into the whole of Switzerland from Great Britain and Germany in 1897.

There is no ground for satisfaction to us in these figures. It will be noticed that there are only three British items which exceed the German figures, *viz.*, (1) sulphates of iron, copper, and zinc; (2) ferrocyanide of potash, chlorate, and red chromate; (3) alum, carbide of calcium, and various. It must, of course, be recognised that Germany is more favourably situated than Britain to supply many of the articles at lower prices; this is especially the case with salicylic acid, sugar of lead, borax, aniline oils, &c. But there is no valid reason why the trade in what few articles we excel in should not go on increasing, and some effort ought to be made to remedy the existing state of affairs. In household soap we appear to have little or no competition, having supplied 18,950*l.* worth against Germany's 2,190*l.*, but in perfumed soaps we were beaten by 4,330*l.* worth more obtained from Germany. Here is an opening for us. Glancing at the French figures we find that that country sold Switzerland drugs and chemicals to the value of 152,156*l.* against our 55,226*l.*, and 153,472*l.* worth of oils, soaps, and fats, against 33,706*l.* from this country. Mr. St. John points out that "many manufacturers in Great Britain regard Switzerland as a mere cypher—a country in which the whole population amounts to some three million souls. But this small country has a general trade of 71,000,000*l.*, showing a greater proportion of exports and imports per head than any other country in the world." He also significantly adds that while France

——	Germany.	Great Britain.
	£	£
Druggists' sundries—		
Pharmaceutical raw materials	4,777	..
Drugs	10,322	1,789
Alkaloids	17,440	160
Quinine sulphate; refined camphor	17,700	768
Mineral waters	13,674	..
Pharmaceutical preparations—		
Packed for wholesale	10,976	1,248
„ retail	2,996	1,624
Perfumes and cosmetics—		
Packed for wholesale	496	..
„ retail	3,640	..
Chemicals—		
Colophony, pitch, &c.	5,307	..
Caustic potash, caustic soda, &c.	21,137	2,997
Chloride of lime	3,466	3,190
Hydrochloric acid, crude	14,578	..
Sulphuric acid, crude	12,769	..
Soda, calcined	31,366	..
Acetate and sulphate of aluminium	6,358	..
Sulphates of iron, copper, and zinc	6,060	7,171
Epsom and Glauber salts, chloride of barium, &c.	14,185	826
Aniline oil, &c.	91,048	5,312
Benzine, naphtha, paraffin, purified vaseline, &c.	18,037	286
Arsenic acid, sugar of lead, borax, salts of soda, not described.	46,351	2,105
Gallic acid, tannic acid, tannin extracts	3,233	..
Glycerin	6,838	761
Acetic acid, crude	6,234	..
Ferrocyanide of potash, chlorate and red chromate.	2,909	4,098
Oxalic acid, oxalate of potash	1,869	..
Arseniate, bicarbonate, hyposulphite of soda.	853	..
Phthalic acid, resorcin	13,456	..
Potash, carbonate	810	..
Castor oil sulphoricinic acid	671	..
Salicylic acid	2,138	..
Sal ammoniac, ammonia	5,756	..
Refined nitre	6,522	..
Nitric acid	2,636	..
Sulphuric ether	3,590	..
Salts of tin	2,282	..
Boracic, pure carbolic, phosphoric acids, &c.	14,218	1,358
Tartar emetic, cyanide of potash, phosphorus, &c.	2,388	528
Bromine, iodine, carbonate of magnesia, &c.	20,666	8,204
Citric acid, tartaric acid	7,032	2,454
Starch and dextrine, for wholesale	10,316	1,739
„ „ „ for retail	10,694	518
Purified rosin	936	1,573
Alum, carbide of calcium, and various	3,273	3,805
Scientific instruments and apparatus	27,850	1,236
Prepared artificial manure	65,226	..
Raw manure, Chili nitre, waste sulphuric acid.	62,123	..

and Germany got 20,000,000*l.* out of Switzerland in 1897, England only took 2,000,000*l.* This fact in itself ought to suggest that we should find it worth while to bestir ourselves, especially as we buy Swiss goods to the annual value of nearly 6,000,000*l.* Mr. St. John concludes his report with an interesting proposition, *viz.*, that to encourage British trade with Switzerland we should establish at Zurich an Anglo-Swiss Chamber of Commerce and sample depôts under British control. We have no great love for sample museums looked after by officials who have little special knowledge of the goods which they are made custodians of, nor particular inducement to take orders for, but we have faith in British enterprise, and as Switzerland is a favourite holiday resort perhaps those who would follow Mr. St. John's advice may see for themselves on the spot what they can do to secure some of the orders which are so prolific there.

Sicilian Chemical and Sulphur Trade.

Foreign Office Annual Series, No. 2331 ; *through Chem. Trade J., Sept.* 2, 1899.

Palermo.

Sulphur is the chief chemical product of Sicily, but there are many other items of interest in the imports for 1898, of which the following is an abstract.

Articles.	General Total.	From United Kingdom.
	Kilos.	Kilos.
Linseed oil	90,664	85,876
Potash and caustic soda	334,986	270,956
Carbonates, potash and soda	244,677	136,696
Chlorates	83,856	3,260
Nitrate of soda	16,609	13,480
Sulphates, ammonia and copper	406,682	467,124
Paraffin wax	39,955	30,089
Gums and resins	38,587	14,550
China clay and chalk	872,425	866,810
Cement	1,212,554	..

Sulphur.—In the extraction alone of this mineral some 30,000 people are employed. During the past two years the production of ore has been as follows:—1897, 3,092,382 tons; 1898, 3,163,146 tons.

In 1897 there were 642 mines in activity, whilst in the year 1898 the mines in activity reached a total of 695. In 1899 the total mines and output will again increase.

The exports of sulphur in 1897 amounted to 427,823 tons, whereas in 1898 the figures rose to 462,393 tons, which is principally attributed to the demands of the United States owing to the war with Spain.

The increase in the exports is also due to the demand for sulphur in the manufacture of wood pulp, and for treating vines.

The stock of manufactured sulphur on hand on December 31, 1898, was about 235,022 tons.

The principle ports from which sulphur is exported in their order of importance are: Port Empedocle, the port of the province of Girgenti, exported 207,260 tons during 1898; Catania exported 130,192 tons; Licata, 103,257 tons; whilst Palermo only shipped some 13,000 tons.

The United States were the principal buyers of sulphur in 1898, 142,553 tons being shipped thence. France took over 95,000 tons; Continental Italy, 60,919 tons; Germany, about 28,000 tons; and the United Kingdom and Malta, 26,487 tons.

The *sumach* trade is almost entirely a Palermo industry. A combination has been formed to handle the output for the next five years, during which period the present good marks will have disappeared. The result promised to the industry is better prices for the crop, which will naturally be at the expense of the consumer.

In considering the figures given below as those of the total export trade in this article, it is necessary to note the item "stinco" amongst the "imports." During 1898, 3,596,158 kilos. of stinco were imported from Tunis. This article is one of the principal adulterants of sumach.

The following figures obtained from the Palermo Customs Department show the amount of sumach exported during 1898, and the countries to which this article of commerce was exported:—

Country to which Exported.	Quantity.
	Kilos.
Great Britain	14,927,124
France	10,709,840
United States	4,450,395
Germany	2,248,082
Belgium	1,555,142
Austria-Hungary	1,383,604
Holland	1,189,524
Miscellaneous	657,251
Total, 1898	37,120,962

Of the above total export of sumach, 16,452,826 kilos. were unground sumach, and 20,668,136 kilos. of ground sumach.

It is not at all unlikely that an attempt on the part of the sumach syndicate to force its prices on the market may result in the employment in the dyeing trade of materials which can be substituted for sumach. In the United States chrome is now being largely used where sumach was formerly employed.

Catania.

Exports of sulphur from Catania amounted to 88,371 tons, as against 90,590 tons in 1897.

The operations of the Anglo Sicilian Sulphur Company, Ltd., which controls about 70 per cent. of the entire Sicilian production, continue to give satisfaction to the producers and refiners at Catania. The average price for crude sulphur, taking best thirds as a basis, was about 3*l*. 14*s*. 6*d*. per ton f.o.b. Catania.

Licata.

The output of sulphur, or, properly speaking, the quantity of sulphur conveyed to Licata during the year under report, amounted to 102,636 tons, which, added to the 70,857 tons remained stored up to Dec. 31, 1897, formed an aggregate quantity of 173,493 tons, 103,558 tons of which having been shipped during last year, a stock of 69,935 tons remained on Dec. 31 last.

GERMAN EXPORTS OF SOAP AND PERFUMERY.

U.S. Cons. Reps., Sept. 1899, 129.

Among the articles of German manufacture of which exports are steadily growing, are soap and perfumery. The value of toilet soap exported from Germany rose from 904,000 dols. in 1897 to 999,600 dols. in 1898, whereas in 1889 the German export in this line amounted to scarcely 475,000 dols. The principal countries buying fine soap in the German market were :—

Country.	1898.		1897.	
	Met. Cent.	Lb.	Met. Cent.	Lb.
England........	10,141	2,235,685	8,726	1,923,784
Belgium........	2,267	499,783	1,838	405,205
Switzerland	2,300	507,058	1,873	412,922
Netherlands....	2,180	480,603	1,875	473,338
France	2,046	451,061	1,510	332,895

Russia, China, and the Dutch East Indies also receive considerable quantities of German fancy soap. A falling off is observable in the exports to the United States only, where this branch of manufacture has so largely developed in the course of the last few years as to compete with the German trade.

Germany's exports of perfumery amounted in 1898 to 2,118,000 dols., being an increase of nearly 250,000 dols. over those of 1897. Germany's most important customers for this article are Belgium, Holland, Austria, Russia, British East Indies, China, the Dutch East Indies, and Australia. There has been an increase in 1898 in the exports of German perfumery to all these countries; only the exports to the United States and Switzerland show a falling off.

GERMAN CHEMICAL TRADE IN 1898.

Chem. Trade J., Sept. 9, 1899, 163.

Chemicals.—The table given in the next column is a summary of the chief chemical export and import trade between Germany and Great Britain in 1898.

Complaints have been made in the chemical and pharmaceutical trade that competition has reduced profits to a minimum. Exceptions to this rule are the new patent medicines, which, being protected by patent, can command a higher price than the cost of the components. The industry in spirit preparations has not been able, in spite of various legislative privileges, to mitigate the injury to their trade caused by the rigorous "Brantweinsteuer" law. In exports the lost ground will never be regained.

Great Britain obtains the greatest benefit from this law, for since 1888 the whole of the tax on spirit exports has been reimbursed. In the United Kingdom the business in tinctures and such preparations has rapidly developed, principally at the cost of the German industry, which has been paralysed by the tax regulations.

The trade in *borax* and boracic acid has experienced many changes during the past year. The Union of German Borax Manufacturers lowered their price on May 1 from 50 to 47 marks per 100 kilos. On January 1 this year the price was raised to 50 marks. It is possible that a further rise in price may take place, owing to the formation of a ring. The new syndicate will include British, French, and South American firms. South America is expected to supply the raw material, but the refining is to be done exclusively in Europe.

The Anglo-German firms in the *oxalic acid* trade were ceaselessly employed during the whole of the year to supply the demand. Prices, however, could not be kept up as so many new firms started which did not belong to the syndicate. Over-production will undoubtedly be the result, and the price will sink still lower. The export of oxalic acid from Germany was more than in the previous year, 52,726 cwts. being exported, compared with 47,591 cwts. in the previous year, of this the United Kingdom took 8,333 cwts.

The trade in *sulphate of ammonia* was more flourishing than in the previous year. With the exception of March, April, and May (when the trade suffered from the Spanish-American war), the prices steadily rose until at the end of the year they attained a height which they had not reached since 1895.

Bleaching Powder.—The past year was so unfavourable for the manufacturers of chloride of lime that it became necessary for them to meet and fix the price so that it left a margin of profit. This caused a rise of 20 per cent. The paper and bleaching mills use the best qualities of chloride of lime, while the inferior kinds are used for disinfection. British chloride of lime is less wanted in Germany than formerly, as the electrolytic system of production provides Germany with as much as she requires, particularly as a duty of 3 marks per 100 kilos. is levied, and must be deducted from the already low prices. In the past year the import amounted to 3,452 cwts., while the export from Germany amounted to 376,625 cwts. By far the greater part of the chloride of lime used in Germany is produced

Imports from Great Britain.

Name of Wares.	Quantity.	
	1898.	1897.
	Tons.	Tons.
Caustic soda........................	509	783
Ammonium carbonate	1,371	1,382
„ sulphate	19,987	23,637
Anthracene..........................	6,815	5,176
Borax, boracic acid	1,821	1,805
Chromate of potash..................	469	445
Raw glycerin........................	3,891	4,519
Indigo..............................	121	167
Carbolic acid	3,650	3,272
Sodium sulphate	650	1,040
Coal-tar oil (light)................	2,841	6,832
Superphosphate	23,260	21,959
Natural colouring earths	2,710	2,319
Phosphate of lime (natural)	1,637	4,211
Kaolin, feldspar, fireclay..........	74,047	77,944
Strontian...........................	8,817	7,609
Lead ore............................	9	1,993
Iron ore............................	15,388	10,395
Thomas's slag (ground)	13,505	20,182
Pitch (excepting asphalt)...........	44,528	35,766
Tar.................................	10,757	7,852

Exports to Great Britain.

Ultramarine.........................	1,748	1,594
Alizarine	2,051	1,971
Aniline and other coal-tar stuffs ..	4,007	3,517
White lead	10,393	9,532
Chlorate of potash	10,986	9,473
Glycerin (purified)	393	647
Red lead	2,299	1,858
Nitrate of potash	3,761	2,749
Tartaric acid	803	819
Protoxide of zinc...................	6,453	5,624
Kali salts (abraumsalze)............	20,494	44,166
Rape-seed oil (in barrels)	2,607	2,118
Oil cakes...........................	59,615	53,700

by the electrolytic method, and the prejudice which formerly existed against this mode of production is nearly removed. In fact, many firms which produced chlorates and alkalis by the old method were obliged to adopt electrolysis in order to obtain anything like remunerative prices. Electrolytic works are in course of construction in the United Kingdom, Belgium, Russia, Austria, and America, so that there is every danger in the near future of over-production, unless some other additional use for chloride of lime should be discovered.

The *glycerin* market was much quieter than in the previous year, when a North American ring sent the price up to 120 frs. for 100 kilos. The past year, however, saw a decrease in the price of raw glycerin to 70 frs. per 100 kilos. The consumption in the United States on account of the war was less than usual. In the last few months much has been required to supply the dynamite factories, therefore prices have gone up and promise to rise still more. The price for purified glycerin was subject to the same variations as that of raw glycerin.

In the past year 185,614 cwts. of raw glycerin were imported, compared with 194,689 cwts. in 1897. Of this 87,149 cwts. came from Great Britain. The import of purified glycerin amounted to 28,977 cwts. compared with 35,612 cwts. in 1897. Of this Great Britain sent 8,232 cwts.

In spite of foreign competition, however, the German glycerin production shows a decided increase, principally in glycerin for making dynamite, of which Cape Colony and the Transvaal took by far the largest quantity. The export of German glycerin in 1898 amounted to 127,300 cwts. compared with 67,935 cwts. in the previous year. Of this amount 8,810 cwts. went to Great Britain. South Africa took much more than half of the entire German export.

The prices of *potash* show a decrease. The causes were: first, large quantities of "schlempe kohle," a refuse product of sugar manufacture, were thrown on the market; and, secondly, the increased production by electrolytic methods of caustic lye, a substance which competes largely with potash. The export of potash was not less than in previous year, amounting to 301,412 cwts., compared with 293,429 cwts. in the previous year. The principal markets were Great Britain, the Netherlands, the United States, and Belgium.

The business in *chlorate of potash and soda* was decidedly unsatisfactory at the beginning of the year, the various factories competing with each other in lowering the price. The last half of the year, however, saw an improvement. The manufacturers came to an understanding by which the prices of chlorate productions, manufactured by the electrolytic method, were fixed at a certain rate. The result was that the price of chlorate of potash rose from 53 to 62 marks per 100 kilos., which price it has retained to the present time.

The import in 1898 amounted to 29,725 cwts. compared with 27,646 cwts. in 1896. Of this 8,259 cwts. came from Great Britain.

The *saltpetre* industry has exhibited many changes during the past year. Although the price of raw kali saltpetre and Chile saltpetre has been kept up, the prices of the manufactured article have gone down, and that too without causing any specially increased sale. The cause of this unsatisfactory condition may be the large number of new factories and the diminished use of saltpetre in the manufacture of explosives. The export from Germany has decreased; Great Britain, however, took 84,244 cwts.

The import of *alkali* from Great Britain to Germany has decreased during the past year from 8,272 tons in 1897 to 6,623 tons in 1898. The reason is clearly the increased production of soda from year to year in Germany itself. Germany received from the United Kingdom in the past year 11,742 cwts. calcined soda compared with 20,527 cwts. in 1897, and it must be remembered that a high duty is imposed on the import, so that the prices of British soda must have been exceedingly low. The duty of 2*s*. 6*d*. per 100 kilos. is, considering the low value of the material, so disproportionately high that it is to be hoped that the next commercial tariff will deal with this question.

Of the *persulphates* the most important is the potassium salt, which is used as a developer in photography. The use of sodium persulphate has greatly increased in Germany for medicinal purposes, and also as an antiseptic.

A great change seems imminent in the manufacture of *sulphuric acid*. The Badische Anilin und Soda Fabrik has patented a most important improvement in the production of this substance. By this new process there is an immense saving in fuel, and the expensive platinum rectifying apparatus is no longer necessary. No saltpetre is required by the new process.

Phosphorus.—There is not much favourable to report in the market for phosphorus. A movement is on foot to form all the German factories into a syndicate. The last year, however, shows no decrease in the imports from foreign lands. 5,928 cwts. were imported compared with 5,831 cwts. in 1897. Of this Great Britain sent by far the largest part, 5,121 cwts.

Benzine.—After much discussion the Benzine Convention is at last an accomplished fact. This Convention, which includes 30 establishments in Germany, Belgium, Lexemburg, and Switzerland, will last for three years. It commands a production of 35,000,000 kilos., it regulates the amount of production, and rules the prices. This Convention was the outcome of the exhorbitant prices demanded by the Standard Oil Company, and the benzine manufacturers hope to keep their prices proportionately high.

The manufacture of *sugar of lead* has not been profitable during the past year. The export is from year to year decreasing. In 1896 it amounted to 1,533 tons, in 1897 to 1,176 tons, and in 1898 to 1,119 tons. The main reason for this retrogression is the establishment of new factories in other countries with which the German manufacturer, on account of the high import duty, finds it impossible to compete. These unfavourable conditions have been intensified by the difficulties in the spirit trade, spirit being the principal raw material necessary to the production of sugar of lead. The enormous rise in the price of spirit in the spring of 1898, cause a rise in the price of sugar of lead of six marks per 100 kilos. A fall in the autumn in the price of spirits brought the price of sugar of lead down by two marks. The prospects for the present year are, however, very gloomy, for the maintenance of high prices by the spirit "ring" render a profitable production of this substance impossible.

Artificial Indigo.—Among new manufactures the manufacture of artificial indigo is decidedly the most important The most sanguine anticipations of the manufacturers have been realised. The favourable practical results of the new manufacture have convinced the consumers of the great advantages which it possessed, and all doubts as to its equality with the natural product have disappeared. In fact, artificial indigo is a perfect substitute for the natural product. This has, of course, led to the establishment of numerous factories for its production; this fact, together with the low price of the natural indigo, will eventually cause some difficulties in the trade.

Soap and Oils.—The German soap manufacturers have petitioned for a decrease of the import duty on maize oil, but it is the opinion of the Chamber of Commerce at Hamburg that those who support this measure cannot be aware of the capabilities of the German linseed oil industry, which amounts annually to 165,000 tons. Of the quantity produced in Germany, at least 50 per cent. is used in the soap manufacture, and should a lower duty be levied on the import of maize oil, it would be a severe blow to the German linseed oil industry. The Bundesrath therefore decline to accede to the proposals of soap manufacturers. Later, the combined linseed and palm oil manufacturers presented another petition, which they hope will relieve their trade. They propose to raise the tax (4 marks) which already exists on cotton oil, a material used freely in many industries. They state that the import of this oil is rapidly increasing, and that the large supply is an injury to the German oil industry and to agriculture. They have the more hope that this request will be granted, as Germany imposes a lower duty than most other countries on the import of cotton oil.

PLATINUM IN BRITISH COLUMBIA.

U.S. Cons. Reps., Sept. 1899, 146.

It is generally believed that there are considerable deposits of platinum at several points in this province, especially in the Similkameen division of the Yale district. Large quantities of platinum have been found in the eastern portion of British Columbia, between Calgary, on the line of the Canadian Pacific Railway, and Edmonton, in the North-West Territory.

One of the best mining engineers here said that platinum, osmium, and associated minerals were found wherever there were placer deposits of gold. This gentleman also stated as his opinion that there was a considerable quantity of platinum and associated minerals in the placer-mining districts in Alaska and the British North-West Territory. He believes that much platinum is thrown away by the miners in the placer districts, for the reason that the miners working for gold do not recognise the other mineral of almost equal value. Considerable search is now being made for platinum by men of experience. The deposits on the Fraser River near Lillooet and on the Tranquillo River have not yet yielded largely; but the belief is general here that good amounts may be obtained if proper efforts for its production are made.

GENERAL TRADE NOTES.

WOOD PULP AT GOTHENBURG IN 1898.

Foreign Office Annual Series, No. 2337, *Aug.* 1899.

Sulphite as well as sulphate pulp found a good market at remunerative prices. There exists, however, some apprehension that the many new mills will increase the output to such an extent that the market will not be able to absorb the production. So far this predicted decline has not yet been felt; in fact the year closed with rather an upward tendency of the market. A considerable increase in the consumption of chemical wood pulp must be the cause of the brisk demand with which this article met throughout the year. The quotations during the year, f.o.b. at Swedish port, subject to quality and time of delivery, were as follows:—

——	From			To		
	£	*s.*	*d.*	£	*s.*	*d.*
Sulphite, unbleached	7	15	7	8	6	8
Sulphate, „	7	4	5	7	15	7

Mechanical wood pulp occupied a poor position with declining prices due to a considerable export to Europe from Canada and the United States of America, which gave rise to a reckless speculation, with the object of reducing the prices, particularly for moist pulp, to absolutely unprofitable figures. There are prospects of Scandinavia resuming its leading position in regard to this article. During the latter part of the year an improvement of prices was perceptible, and it is believed that the manufacture of ground wood pulp in this country will again prove a profitable industry. The production in Sweden has not of late been increased in any marked degree. The quotations during the year, f.o.b. at Swedish port, subject to quality and time of delivery, were as follows:—

——	From			To		
	£	*s.*	*d.*	£	*s.*	*d.*
Mechanical, dry	[illegible]	6	8	3	14	5
„ moist	1	11	1	1	15	7

CHEMICALS IN MEXICO IN 1898.

Foreign Office Annual Series, No. 2336, *Aug.* 1899.

The increase in the value of imported chemical products in 1898 amounted to more than 30,000*l.* over those for 1897. Caustic soda and potash represent a value of more than 4,000*l.* above what was imported in 1897. This increase in the imports of these articles is due to the cotton mills, bleaching works, and soap factories that have lately been established in the city of Mexico, Guadalajara, Monterey, and several others in the State of Coahuila, owned by a syndicate known as the "Compañia Industria Jabonera de la Laguna." The production by the chemical factories in this city is not nearly enough for the consumption. The remainder of the increase is to be found under "Miscellaneous drugs and chemicals," and other special preparations not otherwise specified.

The increase in the value of the imports of paper and its manufactures represents nearly 40,000*l.* over that of 1897, the value in 1898 being 306,234*l.*, against 267,525*l.* in 1897. The articles in which this increase is most noticeable are: cigarette paper, unsized paper for printing, packing paper, cardboard, and manufactures of paper and cardboard.

Paints and colours are in much demand, especially for decorative purposes. The quality of those obtainable is so poor that if British manufacturers were to send their products to this market there is every reason to believe that they could find a ready sale.

Glass of all kinds, china, porcelain, and earthenware are all articles in which Great Britain has no representation, due in a great measure to the manufacturers themselves, who will not fill the orders according to the samples that are very often sent. If their attention were turned to these details there is no reason why articles of British manufacture should not be imported in much larger quantities than at present.

DELETERIOUS SHEEP-DIP.

Chem. and Druggist, Sept. 2, 1899, 388.

The Cape Government have great faith in the superiority of lime and sulphur dip over any other. This opinion is not shared by the Bradford Chamber of Commerce, the President of which, in reply to a letter from the Agent-General for the Cape asking for an opinion as to whether a lime and sulphur sheep-dip was injurious to Cape wool, states that the Wool Supply Committee's opinion is that such a dip is very detrimental to the wool. We understand this opinion is also largely supported in the United States.

METHYLATED SPIRIT.

Rep. of Commissioners of Inland Revenue for Year ending March 31, 1899.

The volume of spirit methylated during the year amounted to 4,781,369 proof galls., or almost 2½ per cent. of the total amount of spirit manufactured or distributed during the year. There are 27 persons or firms engaged in the methylation of spirit in the United Kingdom, the numbers being exactly as last year. Since 1890 there has been a remarkable change in the kinds of spirits methylated, foreign spirit being almost excluded. This is owing to the change effected in the import duties five years ago, which put home-distilled spirit on a more favourable footing than the foreign article. The following figures show, not only the total production of methylated spirit during the past 10 years, but the origin of the spirit:—

Year.	United Kingdom.	Foreign.	Total.
1890	2,165,684	1,022,621	3,188,306
1891	3.160,577	290,313	3,450,890
1892	3,062,240	455,533	3,517,773
1893	2,889 317	645,517	3,534,834
1894	3,106,881	436,705	3,543,586
1895	3,139,054	447,949	3,587,003
1896	3,838,082	919,990	3.930,072
1897	4,118,874	24,436	4,143,310
1898	4,460,862	1,706	4,462,568
1899	4,781,369	3,780	4,789,149

The amount of spirit methylated in the three countries during 1898–99 was:—In England, 4,152,173 galls.; in Scotland, 587,823 galls.; and in Ireland, 45,153 galls. These figures refer to proof gallons. The amount of foreign spirit used in England was 3,045 proof galls., and in Scotland 735; Ireland has not used any foreign spirit for methylation during the past three years. The highest amount of foreign spirit methylated in England was in 1890, when the total was 723,931 galls., and in Scotland in the same year 291,001 galls. were so treated; but there was a rapid diminution in both countries until 1895, when Scotland used 107,493 galls. (about 30 per cent. more than in the year preceding). Since then the figures have steadily gone down. There has been an increase in the number of retailers of methylated spirit during the year, the total now being 14,833, of whom 12,542 are in England, 1,588 in Scotland, and 703 in Ireland.

Calcium Carbide in the Transvaal.

Chem. Trade J., Sept. 16, 1899, 180.

The latest "concession," or barrier against British trade, erected in the Transvaal, relates to the manufacture of calcium carbide. The only patent taken out in the Transvaal for this business was by a Frenchman named Bullier, who thus secured the sole right to manufacture or import calcium carbide. Bullier did not find the business a large one, and he sold his Transvaal rights to a firm of chemical manufacturers, Messrs. Read Holliday and Sons, Ltd., of Huddersfield, who paid him 1,000*l.* for the same. In due course Messrs. Read Holliday and Sons, Ltd., formed a subsidiary company—the Read Holliday Acetylene Company, Ltd., for the special purpose of developing the acetylene gas industry, which latter company duly became the holders of the Transvaal patent rights originally granted to Bullier. The transfer of the patent was duly registered in the Transvaal patent office, the translation being changed from Dutch-French to Dutch-English, the holders being now English; and not alone was this change made in the Transvaal office, but Messrs. Holliday and Sons took out an additional patent for an acetylene gas generator. These patents are strictly in order, and their validity is not disputed by the Transvaal Government. The Read Holliday Acetylene Company, Ltd., therefore justly considered themselves the sole owners of calcium carbide rights in the South African Republic.

Oom Paul, however, had other opinions evidently, seeing that he has simply ignored these rights, and conferred a "concession" to a firm named Tranmer and Co., who hold no patent whatever for the manufacture of calcium carbide, granting them the sole right to make and sell carbide in the Transvaal.

The Company placed the protection of their interests in the hands of Messrs. Ashurst, Morris, Crisp, and Co., who in turn instructed their local agents in Johannesburg, Messrs. Hudson, Hutchinson, and Mullins, to take such steps as they deemed desirable, with the result that they at length received a letter from the Government saying:—"In answer to your last letter of the 5th inst., I beg to inform you, that if your clients, being the holders of the letters patent, are of opinion that Tranmer and Co. infringe the rights granted to them, they can institute an action against those parties in a competent court."

The patent owners will no doubt have to go through the farce of obtaining a legal verdict, either for or against, and to waste much money in the process.

Peroxide of Sodium in Dyeing.

Chem. Trade J., Sept. 9, 1899, 165.

Peroxide of sodium has since its introduction found many applications in the bleaching of wool and silk, for which purpose it has shown itself superior to other bleaching agents. Now, however, it has been pressed into the service of the cotton dyer. Messrs. Leopold Cassella and Co., of Frankfurt-am-Main, have lately introduced a new dyestuff, Immedial Blue C, for dyeing cotton, and for the purpose of fully developing and fixing the colour on the fibre they make use of the oxidising properties of sodium peroxide, by passing the dyed cotton through a bath prepared by partially but not completely neutralising the sodium peroxide by the addition of sulphuric acid. Having thus been introduced for developing colours on cotton, it is quite possible its use may be extended to other colours possessing similar properties to Immedial Blue C.

The Production of Mica and its Uses.

Globe, Sept. 4, 1899.

According to the *Pioneer*, Bengal still holds the first place in the world's production of mica, and not only does it produce the largest amount of merchantable mica, but the quality is unapproached by any of the other mica-producing countries. When it is remembered that the Hazaribagh Mines alone employ 5,587 persons, and that mica is easily mined, and can be had in large quantities, it would be well within the mark to say that the exports represent only one-half the production. Large quantities, chiefly of the inferior kind, are sent to Delhi, Lucknow, and Benares, where the minerals find a ready sale for the manufacture of the cheaper kinds of tinsel ware (imitation). Great Britain, Germany, and the United States are the chief buyers, as mica is indispensable in the manufacture of dynamos. Large sheets of ruby mica are used as coverings for the peep-holes of furnaces, where extreme heat is required; its well known property of imperviousness to radiant heat and its incombustibility making it invaluable for this purpose. The best glass would melt if subjected to the same amount of heat. Mica may be rived into sheets so fine that 1,000 such sheets will only make up a thickness of one inch. Each of these films is a perfect insulator of electricity, which renders the material valuable in the manufacture of secondary batteries. Hitherto the demand has been for fairly large sheets of mica free from buckling and cracks, and of a clear ruby or amber colour. The bulk of the mica, as mined in Bengal, does not answer these requirements. In fact, not 5 per cent. of the mica brought to the surface has been utilised, and great mountains of "waste" are to be seen adjacent to all mines. Just now a demand has sprung up in America for this "waste." Large quantities of it are used in the manufacture of "micanite," a species of cardboard in which films of mica take the place of paper. The mica sheets are split into films about one five-hundredth part of an inch thick, and these are cemented to a jute web. Several thicknesses of films are used, and the whole passed through rollers. A semi-transparent sheet resembling linoleum is produced, and from this any shape of plate can be cut to suit the fancy of manufacturers of electrical machines.

Future of the Industry.

Recent experiments in America have shown that mica films answer better than asbestos as boiler-packing. The air-spaces between the films of asbestos allow of the escape of a certain percentage of heat. The mica being in thin flexible plates, there is less air space, and consequently less escape of heat. Boiler-packing of pure sheet mica gives 30 per cent. better results than asbestos. The usual practice of grinding the mica to a powder and mixing it with large quantities of clay and waste cotton has been abandoned, and mica films alone are used to coat boilers and steam-pipes, the films being kept in place by wire or twine wound round the boiler or pipe. As a packing for ice-boxes, mica waste is unrivalled, as it is far cleaner than sawdust or cork, and is a far better non-conductor of heat. Large refrigerating installations are surrounded with chambers of mica waste, which keeps in the cold as well as throws off radiant heat. But the demand for mica waste for boiler-packing and for refrigerators, although large in itself, falls far short of the demand that may spring up for this material for ceilings for warehouses, and all iron buildings in tropical climates. The well-known property of mica—its imperviousness to radiant heat—renders it the best possible substance for the ceiling of all iron roofing, as this mica ceiling throws off the intense heat of the iron when it becomes hot during the day. A quarter-inch layer of mica waste, placed between common matting and nailed under corrugated roofing, is said to lower the temperature of buildings covered with this material by many degrees. If these experiments can be relied on, then there may be a great future for the mica industry of Bengal, as the amount of mica required for iron-roofed buildings, as well as those covered with tiles, would be enormous, and a ready sale would be found for the bulk of yield of the mines which is new regarded as valueless.

Lithium Minerals and Their Utilisation.

Eng. and Mining J., Sept. 9, 1899, 302.

Probably it is not generally known to manufacturing chemists that the United States has vast resources in lithium mineral which have never been exploited. Lithium is classed as one of the rare elements, but its compounds are not rare in occurrence or in commerce. At present, the use of lithium salts, especially the carbonate, is chiefly in the preparation of lithia water, which is used extensively for medicinal purposes. There are some natural lithia waters, but a good deal of what is sold as such are artificial. The consumption of lithium carbonate for this purpose in the United States is variously estimated at from 40,000 to 200,000 lb. per annum, all of which is obtained from Germany. The average value of the salt at New York in 1898 was 4·22 dols. per lb. There is good business for some one who will undertake its manufacture in this country, although the price would not keep up if the supply were increased largely.

The commonest lithium minerals are spodumene and lepidolite, the latter known also as lithia mica, though it seldom occurs in large flakes with which the idea of mica is commonly associated, but rather as an aggregate of minute scales, which, examined casually, resemble a pinkish-white micaceous sandstone. It is a complex silicate of potassium, lithium, and aluminium, together with aluminium fluoride; its tenor in lithia, Li_2O, ranges, according to Dana, from 3·87 to 5·88 per cent. Spodumene is a simple silicate of lithium and aluminium, containing, theoretically, 8·4 per cent. Li_2O, but, owing to impurities, usually only 4·49 to 7·62 per cent. It was produced commercially in the United States in 1898, in the Black Hills, whence 500 lb. were shipped, and in Massachusetts, where several tons were obtained. The occurrence of spodumene, however, is insignificant in comparison with the vast deposit of lepidolite which exists in California. The deposit, which is that whence the beautiful specimens of rubellite crystals imbedded in lepidolite that are to be seen in every mineralogical collection are obtained, was discovered in 1888. It is situated about a mile from the Pala Mission, on the San Luis del Rey River, in the northern part of San Diego County, in a hill of dark hornblende and feldspar diabase. About 300 ft. above the valley, on the east side of the hill, there is a pegmatite vein, underlying which is a bed of light-coloured, fine-grained lepidolite, containing crystals of rubellite, which are often found in radiations. The developments already made are said to show a body of mineral which is estimated to contain 1,500,000 tons. The percentage of lithia ranges from 3 to 5 per cent. A recent analysis showed 49·5 per cent. of silica, 1·1 per cent. of manganese oxide, 27·9 per cent. of alumina, 3·5 per cent. of lithia, and 17·6 per cent. of potash.

We have heard that the German manufacturers of lithium salts have made inquiries concerning this deposit, with a view of keeping their control of the world's supply of the raw material and their monopoly in this business. We know that attempts have been made to interest New York chemical manufacturers in the matter, which failed in one case because of the report that the extraction of lithia from this ore would be too costly. But the decomposition of a lithium silicate would not appear to be a very difficult matter, and the lithium once obtained in the form of the chloride, say, the preparation of the carbonate ought not to be much more difficult than the preparation of sodium carbonate from common salt. Anyway, it would appear at first sight, in view of the considerable demand for lithia, its high price, and the large amount of mineral available, that it would be worth while for some chemist to study the problem.

Notes on the Occurrence of Mercury in Canada.

A. J. Colquhoun. J. Canadian Mining Inst. 1899, **2**, 13—16.

Cinnabar has been found in the Kamloops district in a belt extending about 30 miles. It occurs in basaltic and dolomitic dykes traversed by veins of quartz and calcite, in some instances in a pure state and also finely disseminated through the gangue. Cinnabar is also found in altered conglomerates on Mount Hardy associated with copper sulphide and carbonate. In this district a selenide of mercury occurs containing gold and silver. The ores are more or less low grade, but it is urged by the author that with capital and competent management there is a great future for Canada in the working and treatment of cinnabar ores.—J. L. B.

A Notable Canadian Deposit of Chromite.

J. T. Donald. J. Canadian Mining Inst. 1899, **2**, 25—27.

This deposit occurs at Coleraine, Megantic country, near Little Lake St. Francis, as a belt in the serpentine for a distance of 260 ft. The ore has the appearance of being thrust up from below, and, following the lines of least resistance, has spread itself out through fractures and fissures in the serpentine, forming a network of pockets connected by bands of varying width. The main band is 6 to 10 ft. wide in places, and at one point reaches 12 ft. The percentage of chromic oxide varies from 38 to 45 per cent. Concentration experiments have given excellent results.—J. L. B.

Russian Weights and Measures.

Chem. and Druggist, Aug. 26, 1899, 353.

A Reuter telegram from St. Petersburg, dated August 18, states that the new regulation in regard to weights and measures was officially published that day. The Russian pound is fixed as the standard of weight and declared to be equal to 409,512 grms., a pail or vedro is to hold 30 lb. of distilled water at 166° (Celsius), and a garnietz 8 lb. of water. The unit of length is the arshin, equal to 71·12 cm. The metric system is to be optional, and may be used on a par with the Russian in commerce in dealing with contracts, accounts, &c., and after mutual agreement by State and municipal authorities. No one, however, is to be compelled to use the metric system when dealing with the above-named authorities.

Japanese Soap Industry.

Chem. and Druggist, Aug. 26, 1899, 353.

At the present time there are about 30 soap factories in Osaka, but only four or five of them are backed up with a capital of 40,000 to 50,000 yen.* The total output last year was estimated at 700,000 yen, as the result of gradual increase year after year. Of this amount less than one-fifth finds it way to foreign countries. The Osaka factories import tallow from Australia to the extent of 1,200,000 catties, valued at 180,000 yen annually, the home supply often getting exhausted. The wholesale prices of their soaps range between 6 yen and 2 yen per dozen. The principal foreign markets for their soaps are China, Korea, India, and Vladivostock. Samples have been sent to Australia and the United States, but few orders have yet been received from those quarters. The manufacturers once enjoyed a profit of 20 to 30 per cent., but this has been reduced to 10 per cent. or less They have, however, recently raised the prices by 10 per cent. on an average.

Coke as a Fuel for Engines.

Eng. and Mining J., Aug. 26, 1899, 241.

The New England Gas and Coke Company, whose great plant at Revere, near Boston, is gradually coming into use as a pioneer in the supply of fuel in the form of gas to a large city, is actively at work securing customers for the coke which will be one important part of its products. As a beginning it has succeeded in persuading the Boston and Maine Railroad Company to try the use of coke for its locomotives. That company has ordered a number of its passenger engines to be fitted with the proper grates for this fuel, and should the experiment succeed—as there is very little doubt that it will—the engines in freight service will follow. Of course there is no doubt that the coke will answer the purpose, the point to be tested being the economic one, as to its cost in comparison with the bituminous coal now used. For passenger service the cleanliness of the fuel, the absence of smoke, cinders, &c., constitute advantages which will outweigh some difference in cost. We are not informed as to the prices at which coke from the Revere plant will be furnished to large consumers like the Boston and Maine Company, but they will doubtless be put at a moderate level. In such a plant as that of the New England Company, the coke will be a by-product, and the company can and probably will dispose of it at low prices in order to make a market.

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* 1 yen = 2*s*.

TITANIUM IN NEW ZEALAND.

***Eng. and Mining J.*, Aug. 19, 1899, 220.**

The New Zealand *Mines Record* for June says: "The Government analyst has ascertained that practically the whole of the titanium in the Taranaki black sands that he has recently been analysing is in the magnetite. This, as he observes, goes to prove that both the electro-magnetic process and the sifting process are useless for the purification of this sand from titanium. In fact, as regards the sifting or riddling process, its effect is rather to increase the proportion of titanium in the ore saved for smelting, as the magnetite is the finest-grained part of this sand. This also applies to the electro-magnetic process."

A FRENCH SUBSIDY FOR SHALE OIL.

***Petroleum Ind. and Tech. Rev.*, Aug. 26, 1899, 460.**

The French Government, in order to encourage the development of the production of oil from shale, decided on the 22nd June last to offer a special premium to the refiners for the next six years, on the following conditions: That in the course of the first year the total sum expended on premiums shall not exceed 300,000 frs.; this sum is to be divided *pro rata* between the refiners, according to their production. At the same time, these premiums shall not represent more than 3 frs. per hectolitre of unrefined oil. During the third and fourth years the total sum paid in premiums shall not exceed 200,000 frs., and not more than 2 frs. per hectolitre. In the fifth and sixth year the total amount is not to exceed 100,000 frs., or more than 1 fr. per hectolitre. This subsidy on the part of the French Government will, no doubt, have some effect on the shale oil industry of Scotland.

NEW SOURCE OF GUTTA-PERCHA.

***Chem. and Druggist*, Aug. 26, 1899, 352.**

M. Jouffroy d'Albans, the French Consul at Singapore, writes to the *Courrier de Saigon* regarding an invention made by a Frenchman in the Straits to extract gutta-percha, principally from the leaves of *Isonandra Hookeria*. The leaves, dried, are sent to Belgium and France for the extraction of the gutta. This trade in dry gutta-percha leaves has considerably increased at Singapore and Penang. The gutta thus produced is said to be of such high quality that the Eastern Extension Cable Company has contracted with the inventor for a supply of it.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st August	
	1898.	1899.
	£	£
Metals	1,754,453	2,520,550
Chemicals and dyestuffs	377,046	435,478
Oils	787,978	917,819
Raw materials for non-textile industries.	6,102,167	6,512,586
Total value of all imports	37,204,185	40,693,398

SUMMARY OF EXPORTS.

Articles.	Month ending 31st August	
	1898.	1899.
	£	£
Metals (other than machinery)	2,857,528	,179,196
Chemicals and medicines	612,241	699,437
Miscellaneous articles	2,649,121	2,765,832
Total value of all exports	20,186,016	22,258,538

IMPORTS OF METALS FOR MONTH ENDING 31ST AUGUST.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
Copper :—				£	£
Ore	Tons	11,471	13,830	41,421	88,579
Regulus	„	5,151	8,356	137,915	260,847
Unwrought	„	5,661	5,975	288,592	447,438
Iron :—					
Pig and puddled	„	11,246	16,200	44,502	71,513
Ore	„	507,247	646,955	382,891	492,960
Bolt, bar, &c.	„	7,365	6,747	55,339	52,737
Steel, unwrought	„	4,403	4,994	27,419	27,729
Lead, pig and sheet	„	13,881	14,630	179,228	211,853
Pyrites	„	58,202	50,054	94,404	88,467
Quicksilver	Lb.	63,555	61,460	6,413	6,450
Silver ore	Value £	..	..	104,572	78,813
Tin	Cwt.	25,488	40,122	88,415	281,144
Zinc	Tons	5,617	5,814	103,722	143,882
Other articles	Value £	..	..	199,629	268,138
Total value		..	..	1,754,453	2,520,550

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH ENDING 31ST AUGUST.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Alkali	Cwt.	22,812	15,537	12,650	9,061
Bark (Tanners', &c.)	„	35,969	64,055	16,614	27,829
Borax	„	80	8,048	104	4,031
Brimstone	„	48,152	27,536	10,470	6,926
Chemicals	Value £	..	..	119,009	130,343
Cochineal	Cwt.	161	594	848	3,069
Cutch and gambier	Tons	1,105	2,164	19,722	28,522
Dyes :—					
Alizarin	Value £	..	..	16,976	19,754
Anilin and other	„	..	..	43,496	44,215
Indigo	Cwt.	852	441	15,314	7,959
Nitrate of potash	„	24,144	21,914	17,915	16,249
Valonia	Tons	1,805	1,822	20,396	21,119
Other articles	Value £	..	..	83,532	116,401
Total value		..	..	377,046	435,478

IMPORTS OF RAW MATERIAL FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 31ST AUGUST.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
				£	£
Bark, Peruvian	Cwt.	3,896	3,012	8,575	6,007
Bristles	Lb.	295,769	404,008	33,769	54,902
Caoutchouc	Cwt.	30,158	36,381	400,362	522,121
Gum :—					
Arabic	„	4,527	5,535	7,945	11,139
Lac, &c.	„	7,961	12,059	26,670	41,050
Gutta-percha	„	5,238	7,771	66,783	90,318
Hides, raw :—					
Dry	„	36,358	37,687	90,624	97,998
Wet	„	50,390	70,254	107,016	153,879
Ivory	„	622	932	28,906	40,252
Manure :—					
Guano	Tons	542	3,122	1,896	17,706
Bones	„	2,809	2,874	11,103	17,771
Nitrate of soda	„	5,856	9,738	42,339	73,776
Phosphate of lime	„	35,730	35,329	55,902	59,170
Paraffin	Cwt.	70,104	93,699	61,346	82,213
Linen rags	Tons	2,016	1,756	18,331	14,775
Esparto	„	23,366	14,850	88,361	53,129
Pulp of wood :—					
Chemical	„	18,633	15,577	117,610	117,528
Mechanical	„	20,280	20,771	63,264	49,175
Resin	Cwt.	146,213	266,976	34,132	64,706
Tallow and stearin	„	143,474	166,985	146,749	199,027
Tar	Barrels	25,118	17,202	19,846	15,517
Wood :—					
Hewn	Loads	269,604	341,292	610,672	744,411
Sawn	„	1,183,019	1,113,071	2,800,178	2,678,410
Staves	„	20,669	14,134	89,154	66,136
Mahogany	Tons	5,733	4,735	51,202	47,182
Other articles	Value £	..	..	1,128,432	1,194,288
Total value		..	..	6,102,167	6,512,586

Besides the above, drugs to the value of 72,674*l.* were imported, as against 67,613*l.* in Aug. 1898.

IMPORTS OF OILS FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Cocoa-nut....... Cwt.	31,832	37,131	34,576	44,200
Olive............ Tuns	599	1,861	20,729	64,662
Palm .... Cwt.	83,619	95,736	88,798	103,864
Petroleum ...... Gall.	21,764,305	22,665,448	373,674	392,307
Seed............ Tons	2,372	2,416	45,014	49,406
Train, &c. ...... Tuns	3,512	2,976	57,452	46,757
Turpentine ..... Cwt.	94,871	82,815	100,455	139,247
Other articles Value £	..	..	67,280	77,376
Total value	..	..	787,978	917,819

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Brass............ Cwt.	8,359	8,949	34,338	46,336
Copper:—				
Unwrought.... „	45,026	42,192	118,522	165,142
Wrought ...... „	20,750	10,980	67,988	50,071
Mixed metal... „	21,528	10,114	54,014	33,066
Cutlery ....Value £ Hardwares....... „	..	..	158,633	181,241
Implements...... „	..	..	102,658	119,763
Iron and Steel ... Tons	294,142	290,212	1,832,382	2,253,793
Lead............ „	3,042	2,657	43,676	42,328
Plated wares... Value £	..	..	41,051	35,749
Telegraph wires.. „	..	..	265,501	87,517
Tin .... Cwt.	9,081	7,145	33,394	49,820
Zinc .... „	12,579	4,882	12,268	6,301
Other articles...Value £	..	..	93,103	108,069
Total value	..	..	2,857,528	3,179,196

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Gunpowder. ... Lb.	1,125,600	941,700	21,727	17,736
Military stores.. Value £	..	..	164,694	156,119
Candles......... Lb.	1,583,400	2,407,700	22,493	36,937
Caoutchouc..... Value £	..	..	102,026	113,258
Cement......... Tons	23,765	22,880	46,045	45,488
Products of coal. Value £	..	..	93,417	99,241
Earthenware ... „	..	..	155,602	166,826
Stoneware ...... „	..	..	10,876	13,395
Glass:—				
Plate .... Sq. Ft.	149,982	137,986	6,945	7,964
Flint .... Cwt.	7,374	7,376	17,068	18,158
Bottles .... „	51,047	60,122	25,400	29,198
Other kinds ... „	21,015	21,039	18,499	18,486
Leather:—				
Unwrought .... „	10,092	10,488	92,436	101,249
Wrought......Value £	..	..	36,911	44,197
Seed oil .... Tons	2,838	2,404	51,164	50,612
Floorcloth.......Sq. Yds.	1,754,400	1,971,800	75,589	93,481
Painters' materials Val. £	..	..	128,097	142,835
Paper............ Cwt.	75,516	69,662	109,621	105,812
Rags.............. Tons	5,035	5,129	24,970	27,650
Soap .... Cwt.	72,267	77,685	75,533	77,753
Total value	..	..	2,649,121	2,765,832

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 31ST AUGUST.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali .... Cwt.	271,245	312,086	77,507	85,637
Bleaching materials „	76,969	104,122	20,373	25,192
Chemical manures Tons	53,122	59,719	185,564	259,740
Copper sulphate .. „	482	221	7,792	5,261
Medicines....... Value £	..	..	94,161	93,056
Other articles... „	..	..	226,844	230,550
Total value	..	..	612,241	699,437

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

16,510. C. F. Wormald. A new or improved method of protecting surfaces exposed to very high temperatures, and in the compositions for such purposes. Aug. 14.

16,614. G. J. Clarkson.—From C. E. Snypp, United States. Improvements in presses for expressing or filtering liquids from solids. Complete Specification. Aug. 16.

16,663. J. Overhoff and A. Colautti. Improvements in apparatus for cooling liquids, concentrating solutions, and the like. Complete Specification. Aug. 16.

16,664. J. Overhoff and A. Colautti. Improvements in apparatus for cooling liquids and for concentrating solutions and the like. Complete Specification. Aug. 16.

16,738. G. N. Vis. Improved vacuum evaporating apparatus for separating common salt (chloride of sodium) from solutions, especially from brine. Aug. 17.

16,801. E. Darnbacher and F. Darnbacher. A new or improved protective covering for demi-johns, carboys, bottles, jars, and similar receptacles. Aug. 18.

16,830. K. O. B. Textorius and J. J. Howard. Improvements in and relating to air power generators or compressing apparatus for air or gas. Complete Specification. Aug. 19.

17,174. R. A. Broadhurst and A. Collins. Flow indicator for detecting a flow of liquid or gas in a pipe. Aug. 24.

17,221. W. Anderson. Gas pressure and mixing apparatus. Aug. 25.

17,233. H. Pahaut. Improvements in furnaces. Complete Specification. Aug. 25.

17,620. W. Young, S. Glover, and T. Glover. *See* Class II.

17,689. E. J. Duff and The United Alkali Company, Ltd. Improvements in apparatus for evaporating brine. Sept. 1.

17,690. E. J. Duff and The United Alkali Company, Ltd. Improvements in multiple effect brine evaporating apparatus. Sept. 1.

17,691. E. J. Duff and The United Alkali Company, Ltd. Improvements in multiple effect apparatus for use in evaporating brine. Sept. 1.

17,692. C. Joly. Improved system for the manufacture of volatile liquids and the perpetual production of mechanical energy. Sept. 1.

17,734. J. Turner.—From W. M. Miller, Straits Settlements. Improvements in and relating to evaporating appliances. Sept. 2.

17,968. D. B. Morison. Improvements in and apparatus for evaporating liquids. Sept. 5.

18,251. J. Vicars, sen., and J. Vicars, jun. Improvements in appliances for supplying air to furnaces. Sept. 9.

18,253. W. P. Thompson.—From W. F. Fritz and H. A. Alioth, Switzerland. Apparatus for drawing off determined quantities of liquid carbonic acid or compressed gases or vapours. Complete Specification. Sept. 9.

18,585. J. Carter, C. Carter, and O. Carter. Improvements in kilns and ovens. Sept. 14.

Complete Specifications Accepted.*

1898.

17,204. G. Zschocke. Apparatus for precipitating the solid particles of the top-gases of a blast furnace from out of the clear water. Aug. 23.

19,097. W. Scott. Devices for heating and evaporating liquids. Sept. 13.

20,677. A. de Docte. Apparatus for measuring the colour intensity of coloured liquids and of transparent solid matter. Sept. 6.

21,085. H. G. C. Thofern. Process of liquefying gases, and apparatus therefor. Aug. 30.

21,935. G. B. Ellis.—From La Société Chimique des Usines du Rhône anciennement G. P. Monnet et Cartier, France. Closing devices for vessels containing volatile liquids. Aug. 23.

23,346. E. S. Bond. Means for carrying and storing carbide of calcium. Sept. 13.

23,638. M. Julien. Apparatus for mixing differently miscible liquids or liquefied matters. Aug. 30.

24,542. Baron H. Tindal. Apparatus for sterilising liquids by means of ozone. Sept. 20.

24,543. Baron H. Tindal. Apparatus for generating ozone. Sept. 20.

1899.

1764. B. Baron. — From O. W. Ackerman and P. E. Malmstrom, United States. Means for carbonating liquids. Sept. 13.

4614. C. Bolz. Smoke consuming furnaces. Aug. 23.

11,834. W. P. Thompson. — From W. B. Devereux, United States. Calcining furnaces. Sept. 6.

14,134. R. Fiedler, of the firm of Transportabler Dampfentwickler Gesellschaft. Process for reducing suitable substances into vapours, and apparatus therefor. Aug. 23.

15,754. A. J. Boult. — From C. Krausse, Germany. Refrigerating process, and apparatus therefor. Sept. 6.

II.—FUEL, GAS, and LIGHT.

Applications.

16,618. W. Knapp and R. Steilberg. Process of and apparatus for the production of compressed gas. Complete Specification. Aug. 16.

16,619. W. Knapp and R. Steilberg. Improved process of and apparatus for the production of illuminating gas. Complete Specification. Aug. 16.

16,638. H. Berger. Improved acetylene gas generator. Aug. 16.

16,665. T. Bauer. Coke furnaces worked with "battery" gases and steam preliminary (previously) mixed in collecting channels. Aug. 16.

16,764. W. Wilder, J. W. Wilder, and A. Motteram. Improvements in or relating to night lights and candles which are applicable for illuminating purposes. Aug. 18.

16,792. W. W. Lewis and T. H. Lewis. Improvements in devices for producing acetylene gas light more especially intended for use in cycle carriage and hand lamps. Aug. 18.

16,794. R. O. Tweedie. A new and improved anti-vibrating arrangement for incandescent gas lighting. Aug. 18.

16,810. G. J. Atkins. Improvements in the manufacture of gases, gaseous vapours, and other chemical compounds. Aug. 18.

16,871. R. Haddan.—From J. Spiel, Germany. Improvements relating to petroleum incandescent burners. Aug. 19.

16,918. H. Schäffer. Improved method of preparing solid spirit for burning or other purposes. Aug. 21.

17,053. E. Blass. Process and apparatus for the production of heating gases poor in nitrogen from combustible materials containing hydrocarbons. Complete Specification. Aug. 22.

17,195. A. M. Clark.—From Süddentsche Metallwerke, Schad, Herbest, and Co., Germany. Improvements in acetylene lamps. Complete Specification. Aug. 24.

17,234. R. Marston and J. Parr. Improvements in and relating to the manufacture and use of atmospheric nitrogen. Aug. 25.

17,235. G. Wintzek. Improvements in and relating to the production of coke. Complete Specification. Aug. 25.

17,243. G. Kellaway. Acetylene gas generator. Aug. 25.

17,343. A. Däuber. Improvements in apparatus for making acetylene gas. Complete Specification. Aug. 26.

17,371. J. W. Gatehouse. Improvements in the preparation and production of paraffin or petroleum oils for illuminating purposes by means of ozone or ozonised air. Aug. 28.

17,376. G. F. Lee-Giles. Improvement in acetylene gas purifiers. Aug. 28.

17,396. C. Schnitzler. Improvements in apparatus for generating acetylene. Aug. 28.

17,406. F. Matthews. Improvements in acetylene gas machines. Aug. 28.

17,620. W. Young, S. Glover, and T. Glover. Improvements in apparatus for the fractional scrubbing and washing of gases, also applicable to the fractional distillation of liquids and condensation of vapours. Aug. 31.

17,631. C. B. Richard and F. Cahen. Improvements in or relating to the generation of gas having acetylene as a base, and apparatus therefor. Complete Specification. Aug. 31.

17,765. A. P. E. Danchot and L. M. Saulay. Improved acetylene gas generator and holder. Sept. 2.

17,773. J. R. Rutter and F. H. le Sueur. The portable safety gas generator. Sept. 2.

17,780. K. Kubierschky. Process for separating gases and vapours from mixtures. Complete Specification. Sept. 2.

17,839. W. O. Felt. Improvements in the manufacture of gas. Sept. 4.

17,888. B. E. Chollar. Method of purifying gas. Complete Specification. Sept. 5.

17,969. G. C. Marks.—From J. Hemingway, United States. A new or improved method of apparatus for treating fuel. Complete Specification. Sept. 5.

18,090. A. E. N. Yeadon and J. West. Improvements in apparatus for washing and scrubbing gas. Sept. 7.

18,118. J. A. Mason. Improvements in burners and means for generating gas from oil. Sept. 7.

18,189. C. Dewey and J. A. Chown. An improved device for generating acetylene gas. Complete Specification. Sept. 8.

18,211. H. Higgins. Improvements in or relating to the utilisation of combustion gases. Sept. 8.

18,237. H. S. Ryland. An improved apparatus for the generation of acetylene gas from carbide of calcium. Sept. 9.

18,259. A. W. Puddington. Apparatus for generating and applying oxygen for effecting or promoting combustion in furnaces. Sept. 9.

18,261. W. Smethurst. Improvements in the process and means for the production of gas. Sept. 9.

18,392. W. Hooker. Improvements in and relating to incandescent gas burners. Sept. 12.

18,461. A. P. Canova and W. Thompson. Improvements in and relating to acetylene gas generators. Sept. 13.

18,556. British Pure Acetylene Gas Syndicate, Ltd., and C. E. Talbot. Improvements in apparatus for generating acetylene gas. Sept. 14.

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* See Note (*) on previous page.

18,580. E. J. Duff and The United Alkali Company, Ltd. Improvements in and connected with the treatment of producer gases and apparatus therefor. Sept. 14.

18,581. E. J. Duff and The United Alkali Company, Ltd. Improvements in or connected with gas producers. Sept. 14.

18,582. E. J. Duff and The United Alkali Company, Ltd. Improvements in superheaters to be used in connection with gas producing apparatus. Sept. 14.

18,590. H. R. Chubb and G. Bone. Improvements in apparatus for the generation, condensation, and storage of acetylene and other gases. Sept. 14.

18,750. W. L. Voelker and the Voelker Incandescent Mantle, Ltd. Improvements in and relating to burners for gas lighting by incandescence. Complete Specification. Sept. 16.

Complete Specifications Accepted.

1898.

19,674. J. V. Robinson. Apparatus for the manufacture of acetylene gas. Sept. 13.

19,683. T. R. Waite. Acetylene gas generators. Aug. 30.

20,451. J. Dymond. Gas producers. Sept. 6.

20,626. G. W. B. Crees. Generator of acetylene. Aug. 23.

20,766. W. Forrester. Acetylene gas generator. Aug. 30.

22,826. J. W. Bailey and J. Clapham. Apparatus for generating acetylene. Sept. 6.

23,230. G. A. Gilner. Apparatus for generating acetylene gas. Sept. 13.

24,065. P. Margulies. Acetylene gas generators. Sept 20.

24,543. Baron H. Tindal. *See* Class I.

25,209. E. Pilous, G. Ottermann and E. Nauheim. *See* Class B.

25,771. H. S. Elworthy and H. Lane. Method and apparatus for producing lighting, heating, and power gas. Sept. 20.

26,206. H. Austin. Means employed for carburetting or vaporising oil for use in oil engines. Sept. 6.

1899.

290. F. N. D. Georis. Carburetters. Aug. 23.

1538. M. Koblenzer. Incandescence bodies or mantles for incandescent lamps. Aug. 30.

10,152. L. Steiner. Apparatus for generating acetylene. gas. Aug. 30.

12,150. J. B. de Lery. Incandescent gas burners. Aug. 30.

13,786. R. H. Sutherland, F. Sutherland, and G. Marshall. Apparatus for generating acetylene gas. Aug. 23.

13,805. O. Imray.—From F. C. Wilson, United States. Apparatus for generating acetylene gas. Aug. 30.

13,817. C. Linzen, jun., E. Demmer, E. Disselkamp, E. Disselkamp, and R. Disselkamp. Stoves for lignite cakes, peat, and the like fuel. Sept. 13.

14,124. P. van Hamont. Apparatus for the production of acetylene gas. Aug. 23.

14,499. C. W. Soderberg. Apparatus for generating acetylene gas. Sept. 13.

14,539. M. F. Harrison. Method of and apparatus for washing coal. Sept. 13.

14,984. C. M. Bridges. Acetylene gas generator. Sept. 20.

15,344. D. M. Steward. Gas burners specially adapted for acetylene gas. Sept. 13.

15,506. E. J. Dolan. Method of packing calcium carbide, and generating acetylene gas therefrom. Sept. 20.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Complete Specifications Accepted.

1898.

19,849. W. Schröder. Process for obtaining yellow prussiate of potash as a bye-product in the destructive distillation of coal.

1899.

13,146. C. Döre. Production of solid materials from tar and other substances. Aug. 23.

14,760. P. Schneider. Apparatus for extracting pyroligneous spirit from saw-dust. Sept. 20.

15,238. W. Young and J. Fyfe. Retorts for the destructive distillation of shale. Aug. 30.

IV.—COLOURING MATTERS and DYES.

Applications.

16,473. G. G. Hepburn. *See* Class VI.

16,527. A. Ashworth and J. Bürger. Improvement in the production of colouring matters. Aug. 15.

16,574. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of anthraquinone dyestuffs. Aug. 15.

16,641. J. C. Mewburn.—From The Chemische Fabrik von Heyden, Germany. Improvements in the manufacture of indigo and substituted indigoes and intermediate products. Aug. 16.

16,718. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of dyestuffs of the acridine series and of intermediate products for use therein. Aug. 17.

16,781. R. Zsigmondy. Improvements in the process of preparing red lustre-colours in various shades or tints. Aug. 18.

16,807. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. A new process for the production of naphthol derivatives. Aug. 18.

16,937. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Improvement in the manufacture of colouring matters. Aug. 21.

17,117. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new anthraquinone dyestuffs. Aug. 23.

17,118. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of chemical compounds of the aromatic series. Aug. 23.

17,206. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of anthraquinone dyestuffs. Aug. 24.

17,346. L. O. Helmers. Improvements in sulphonic acid salts of alkaline earthy metals and metals proper and their sulphonic acids and process of making same. Aug. 26.

17,426. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of colouring matters of the acridine series. Aug. 28.

17,427. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of acridinium derivatives. Aug. 28

17,636. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new substantive azo colouring-matters. Aug. 31.

18,105. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of a sulphurised black dyestuff. Sept. 7.

18,409. A. F. Poirrier. Manufacture of new substantive black colouring matters. Sept. 12.

18,658. A. G. Green, A. Meyenberg, and The Clayton Aniline Company, Ltd. Improvements in the manufacture and production of colouring matters containing sulphur. Sept. 15.

18,730. H. E. Newton.—From the Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of dyestuffs for cotton. Sept. 16.

Complete Specifications Accepted.

1898.

21,596. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of acid dyestuffs of the diphenylnaphthylmethane series. July 26.

21,832. A. G. Green, A. Meyenberg, and The Clayton Aniline Company, Ltd. Manufacture and production of colouring matters containing sulphur. Sept. 6.

22,106. O. Imray. From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of amido-acylamido carbonic acid esters. Aug. 23.

22,459. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of products and colouring matters related to the indigo group. Aug. 30.

22,460. A. G. Green, A. Meyenberg, and The Clayton Aniline Company, Ltd. Manufacture and production of colouring matters containing sulphur. Aug. 30.

22,765. W. McCowan. Manufacture of colouring matter. Sept. 6.

23,712. D. C. Bendix. Manufacture of dry alizarine colours. Aug. 23.

24,183. Vidal Fixed Aniline Dyes, Ltd., and L. Haas. Manufacture of colouring matters. Aug. 30.

24,286. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of diamidodiphenylamine disulphonic acid, and azo dyestuffs therefrom. Sept. 13.

24,752. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of new colouring matters of the naphthalene series. Sept. 20.

24,830. H. H. Lake. — From Farbwerke Mühlheim formerly A. Leonhardt and Co., Germany. Manufacture of colouring matters. Sept. 6.

25,650. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of disazo colouring matters and of products for use therein. Sept. 20.

26,167. H. R. Vidal. Manufacture of colouring matters. Sept. 13.

26,168. H. R. Vidal. Manufacture of colouring matters. Aug. 30.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

16,163. A. Wilson. Improvements in the process of heckling flax and other fibrous materials, and in machines employed for those purposes. Aug. 14.

16,647. W. Brothers. Improvements in the treating of textile fabrics or materials for the purpose of filling or weighting same. Aug. 16.

16,669. A. Matitsch. Improvements in the manufacture of lace. Complete Specification. Aug. 16.

16,730. W. Mather. Improvements in the treatment of textile materials with liquids, vapours, or gases, and apparatus for that purpose. Complete Specification. Aug. 17.

16,761. J. G. Lorraine.—From J. G. Pratt, United States. New or improved apparatus for treating stalks of fibrous plants. Complete Specification. Aug. 17.

16,811. G. C. Dymond, of the firm of W. P. Thompson and Co.—From L. Cruz-Pasqual-de-Bonanza, J. Selva-Javaloyes, D. Quilez-Quilez, M. Gomez-Valdivia and A. Alonso-Blasco, Spain. An improved fibre applicable to all sorts of weaving and spinning and processes for the treatment or separation of the same. Aug. 18.

16,812. G. C. Dymond, of the firm of W. P. Thompson and Co.—From L. Cruz-Pasqual-de-Bonanza, J. Selva-Javaloyes, D. Quilez-Quilez, M. Gomez-Valdivia and A. Alonso-Blasco, Spain. An improved apparatus for separating the fibres from palms in general and all other textile plants. Aug. 18.

17,642. H. Grandage. Improvements in or relating to the treatment of cotton and other yarns and in apparatus therefor. Aug. 31.

17,806. H. H. Boyle. Improved apparatus for decorticating plants of the fibrous grass kind. Sept. 4.

18,260. J. Imray.—From E. Bronnert, Germany. An improvement in the production of solutions of cellulose and of cellulose and natural silk in concentrated zinc chloride solution. Sept. 9.

18,657. J. A. A. Imbs. Improvements in apparatus for preparing wool cotton or other fibrous material for spinning. Complete Specification. Sept. 15.

Complete Specifications Accepted.

1899.

3213. G. Grandage. Production of ornamental effects upon textile fabrics. Sept. 13.

12,405. F. Hickman and the French-Hickman Flax Fibre Company, Ltd. Manufacture of flax pulp. Aug. 30.

13,135. W. G. Heys.—From H. Danzer, France. Apparatus for preparation of wools for washing and cleaning. Aug. 23.

13,514. G. Grandage. Apparatus for mercerising cotton or other piece goods. Sept. 6.

13,729. E. H. Fuller. Production of ornamental effects upon textile fabrics, and apparatus therefor. Aug. 30.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, and BLEACHING.

Applications.

16,473. G. G. Hepburn. An improved process for the production of azo colours on the fibre. Aug. 14.

16,712. E. Brandenberger and The Maschinenfabrik Fr. Gebauer. Means for impregnating, dyeing, washing, and mercerising textile fabrics. Aug. 17.

16,730. W. Mather. *See* Class V.

16,731. W. Mather. Process and apparatus for continuous bleaching of fabrics in open condition. Complete Specification. Aug. 17.

16,908. F. A. Boyes and J. Miles. Improvements in means for conducting or guiding fabrics when under treatment in bleaching and like processes. Aug. 21.

17,295. J. Smith. Improvements in or connected with dyeing textile materials aniline black, partly applicable also to dyeing textile materials other colours. Aug. 26.

17,360. J. Longthorpe and W. Dargue. Improvements in machines for washing, scouring, mordanting, and cleansing hanks and other forms of fibrous substances. Aug. 28.

17,675. J. H. Lees-Milne. Improvements in and in means for winding and subsequently bleaching yarns wound upon tubes in the form of bobbins or cheeses. Sept. 1.

17,785. J. W. Fries. Improvements in and relating to the sizing and dyeing of textile fabrics, yarns, or threads. Sept. 2.

17,872. J. Diederichs. Improvements in the process for printing, transferring, and fixing lithographic colour and the like with an oily or resinous base, especially on to stuffs. Sept. 4.

18,052. W. Clark.—From the firm C. H. Boehringer Sohn, Germany. Improvements in the manufacture of mordants and in alizarine dyeing processes. Sept. 6.

18,498. J. Pfister, H. Paetz, and L. Lewin. Improvements relating to the dyeing of wood, and to apparatus for use in connection therewith. Sept. 13.

18,690. E. Hölken. Improvements in black dyeing. Complete Specification. Sept. 15.

18,742. B. Willcox.—From The Badische Aniline and Soda Fabrik, Germany. Improvements in and means for use in mordanting and dyeing cotton and other vegetable fabrics. Sept. 16.

Complete Specifications Accepted.

1898.

20,562. A. Marr. Apparatus for dyeing, bleaching, drying, and similarly treating yarn in cops and the like. Sept. 6.

20,865. J. Grossmann. Indigo vat. Sept. 20.

21,575. G. W. Johnson.—From Kalle and Co., Germany. Dyeing black with logwood. Aug. 30.

21,833. J. Y. Johnson.—From The Badische Aniline und Soda Fabrik, Germany. Mordanting cotton or other vegetable fibre. Aug. 30.

23,656. H. C. Longsdon. Machinery or mechanism for washing or cleansing, dyeing, and drying clothes, fabrics and the like. Sept. 20.

23,710. C. D. Abel.—From the firm of H. C. Meyer, jun., Germany. Process for dyeing and bleaching cane. Sept. 6.

25,917. C. D. Abel.—From The Actiengesellschaft für Anilinfabrikation, Germany. Dyeing of hair and furs. Sept. 6.

26,602. W. Coventry. Machines for dyeing yarn in the form of cops, bobbins, or the like. Aug. 30.

1899.

10,293. H. von Niederhaüsern. Process for fixing alumina or chromic oxide on textile fibres as mordants, particularly for dyeing in Adrianople or Turkish red. Sept. 6.

11,562. R. Brandts. Process for dyeing yarn roving with indigo blue. Aug. 23.

13,872. W. Coventry. Spindles used for holding yarn during dyeing and the like operations. Aug. 23.

14,932. E. J. Brown. Machines for washing, soaping, scouring, mordanting, bleaching, dyeing, sizing, filling, mercerising, and drying spun or twisted fibres in the thread hank-warp or fabric. Sept. 6.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

16,763. C. H. Worsnop. An improvement in the method of preparing carbide of calcium. Aug. 18.

16,780. J. G. A. Rhodin. A process for the production of soluble potassium salts from felspar (orthoclase). Aug. 18.

16,935. C. E. Acker. Improvements relating to the manufacture of caustic alkali and halogen gas, and to apparatus therefor. Complete Specification. Aug. 21.

16,947. C. E. Acker. Improvements in the manufacture of caustic alkali and halogen gas and apparatus therefor. Complete Specification. Aug. 21.

16,963. C. E. Acker. Improvements relating to the manufacture of caustic alkali and halogen gas, and to apparatus therefor. Complete Specification. Aug. 21.

17,019. P. Guadagnini. Improvements in the manufacture of carbide of calcium. Aug. 22.

17,835. J. E. Carroll. Improvements in and relating to the manufacture of salt. Sept. 4.

17,836. J. E. Carroll. Improvements in and relating to the manufacture of borax. Sept. 4.

18,041. J. Jeffreys. Improvements in the manufacture of chloride of ammonium from salt or other suitable chloride and sulphate of ammonium. Sept. 6.

18,049. J. Wetter.—From The Harkort'sche Bergwerke und Chemische Fabriken zu Schwelm und Harkorten, Germany. Improvement in the manufacture of hydrochloric acid. Sept. 6.

18,263. F. Schmidt. Improvements in the production of a carbon specially suitable for use in the manufacture of calcium carbide. Complete Specification. Sept. 9.

18,565. E. Beringer. Improvements in the manufacture of hydrogen cyanide. Sept. 14.

18,648. A. F. Crosse. Improvements relating to the regeneration of cyanide solutions employed for the recovery of gold or other precious metals. Sept. 15.

Complete Specifications Accepted.

1898.

17,415. J. C. Graham. Apparatus for and method of making caustic alkali and sodium. June 28.

21,126. J. Grossmann. Preparation and manufacture of hydrosulphurous acid and hydrosulphites. Sept. 6.

23,978. F. M. E. Basse and G. Faure. Process for the manufacture of bi-sulphite of soda. Aug. 30.

1899.

862. C. Bigot. Treating borates of lime or magnesia to obtain boracic acid, borax, and ammonia, and nitrate of ammonium. Sept. 6.

7160. C. Wehner and M. Kandler. Production of small masses of calcium carbide. Sept. 6.

13,320. O. Hofmann. Treating cupric sulphate solutions. Sept. 20.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

16,625. L. Grote. Improvement in or relating to machinery for manufacturing glass bottles or the like. Aug. 16.

17,289. A. J. Davis. Improvements in the manufacture of glass tiling and in the coating of same. Aug. 26.

17,339. O. Imray.—From La Société des Verreries de Bruxelles, Belgium. New process for the total or partial hardening of glass. Complete Specification. Aug. 26.

17,382. W. Kiersch. An improved method of glass mosaic decoration. Aug. 28.

18,290. W. Maguire. An improved method of and apparatus for decorating china earthenware and the like. Sept. 11.

18,587. E. Offenbacher. An improved process of manufacturing decorated glass, and machinery therefor. Complete Specification. Sept. 14.

Complete Specification Accepted.

1899.

3307. H. H. Lake.—From V. Micheli, Italy. Manufacture of terra-cotta pottery and the like. Aug. 30.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

16,501. S. Zientarski. An improved process for the production of artificial stone from sand and lime. Aug. 14.

16,579. W. Wright. An improved setting for cements used for constructive purposes, including Portland and Roman cements and concrete or mixtures in which cements for constructive purposes are used. Aug. 15.

16,653. C. F. Cross and E. J. Bevan. Improvements in the manufacture of refractory materials for building and other purposes. Aug. 16.

16,732. C. D. Abel.—From the firm of Berliner Holzcomptoir, Germany. Process for the preservation of wood. Aug. 17.

16,822. G. Liebau. Improvements in fireproof floors and ceilings. Complete Specification. Aug. 18.

16,827. H. D. Blake. Improvements in bituminous asphaltic composition for paving and other purposes. Aug. 18.

16,933. H. Diercks. Beton (cement) ceiling. Aug. 21.

16,981. J. T. Henderson and G. A. Brown. An improved preservative composition for coating wood metal and the like. Aug. 22.

17,471. A. Adams. Improvements in and connected with continuous burning kilns for bricks and other articles. Aug. 29.

17,597. A. Fullarton. Improvements in making artificial stone. Aug. 31.

17,608. W. Siedel. Improvements in the manufacture of cement. Complete Specification. Aug. 31.

17,853. W. P. Thompson.—From the firm of Terranova Industrie, C. A. Kapferer, and Schleuning, Germany. Improvements in the manufacture of cement. Sept. 4.

17,964. R. Haddan.—From G. Fugman, United States. Improvements in fireproof construction for buildings. Complete Specification. Sept. 5.

17,966. R. Haddan.—From La Société Berthe et Cie., France. New or improved artificial granite, and process for the manufacture of the same. Sept. 5.

18,058. H. C. Meurer and F. S. Bormann-Zix. Improvements in and relating to the production of calcareous sandstone. Sept. 6.

18,101. J. Janssen. Generator oven for burning lime and cement. Sept. 7.

18,164. G. Davies.—From J. C. Fender, United States. Improvements in fireproof floor construction. Complete Specification. Sept. 8.

18,203. C. R. Gostling. An improved process for the manufacture of Portland and like cements. Sept. 8.

18,442. R. Stanley. Improvements in the manufacture of bricks, tiles, blocks, and such like articles from plastic and powdered substances. Sept. 12.

18,642. D. W. Hart. Improvements in artificial building materials. Sept. 15.

18,747. The British Uralite Company, Ltd.—From A. Imschenetzky, Russia. Improvements in and relating to the manufacture of fire-resisting materials. Sept. 16.

Complete Specifications Accepted.

1898.

16,697. R. A. Rossborough and J. Pile. Process of treating or preparing clay having large quantities of stones in it for the manufacture of bricks, tiles, and such like. Sept. 13.

18,689. S. Grossiord. Manufacture of artificial stones. Sept. 6.

21,231. J. Armour. Manufacture of building materials. Sept. 6.

22,882. A. J. Boult.—From P. H. J. Gasse, France. Manufacture of artificial stone, marble, and the like. Sept. 13.

1899.

9816. C. W. Stevens. Processes for the manufacture of artificial stone. Sept. 6.

12,663. F. C. W. Timm. Shaft, kiln, or furnace for burning lime, cement, and like substances. Aug. 2.

12,664. F. C. W. Timm. Rotary or revoluble furnaces or kilns for burning cement, lime, and like materials. Aug. 23.

14,602. F. Hoeniger. Concrete, cement, and similar plates and slabs. Aug. 30.

X.—METALLURGY, MINING, Etc.

Applications.

16,514. G. Palis and H. Rügge. Improvements in the production of copper alloys. Complete Specification. Aug. 14.

16,529. E. H. Saniter. An improvement in moulds for the casting of metals. Aug. 15.

16,573. E. Turpaud. Process of treatment of aluminium for rendering it tough and elastic for the purposes of industrial uses. Aug. 15.

16,802. F. Ellershausen. Improvements in the treatment of flue dust or fumes from metallurgical furnaces. Aug. 18.

16,876. C. Göttig and W. Köttgen. An improved cream for obtaining silver coating on metals. Aug. 19.

17,057. G. de Bechi and The General Metal Reduction Company, Ltd. Improvements in and relating to the treatment of ores. Aug. 22.

17,274. R. A. Needham. Improvements in or connected with the process of galvanising iron. Aug. 25.

17,423. W. Ruttenberg and M. van Zanten. A process for the manufacture of a non-metallic solder for soldering sheet metal, particularly sheet metal cans and the like for the storage and transport of solid or liquid substances containing oil. Complete Specification. Aug. 28.

17,659. A. Spies. Apparatus for effecting a more complete combustion of the gases given off in smelting furnaces. Aug. 31.

17,769. J. L. Benthall. An improvement in the manufacture of armour plates. Sept. 2.

17,829. A. K. Huntington. Improvements in apparatus for squirting heated metals. Sept. 4.

17,860. E. Mies and A. H. Mies. An improved process for obtaining permanent deposits of metals on aluminium. Sept. 4.

18,128. J. H. Lee. Improvements in the treatment of ores. Sept. 7.

18,329. J. B. de Alzugaray. Improvements in and connected with the manufacture of metallic alloys. Sept. 11.

18,518. E. Mies and A. H. Mies. An improved process for obtaining metal coatings or deposits. Sept. 13.

18,519. W. E. Harris. Improvements in annealing pots for black plate sheet steel and the like. Sept. 13.

18,648. A. F. Crosse. *See* Class VII.

18,659. B. Scheid. Improvements in the manufacture or preparation of metallic silicon. Sept. 15.

Complete Specifications Accepted.

1898.

18,032. E. Bohon. Method for the extraction of metals from their ores. Aug. 30.

19,168. S. Kurovsky, G. Gschwandtner, and H. Schuster. Extraction of precious metals from ores, slicks, and the like. Sept. 20.

21,306. S. Pitt.—From The Pharmaceutisches Institut, L. W. Gans, Germany. Manufacture of metal leaf. Aug. 23.

21,418. W. Wilkinson. Method of casting and stamping aluminium and other metal articles. Aug. 23.

22,182. A. Reynolds. Blast and cupola furnaces. Sept. 20.

22,366. G. Rigg. Process for the production of oxide of zinc and carbonate of zinc from ores or other materials containing zinc. Sept. 20.

1899.

12,335. E. J. Francis. Process of manufacturing sheet iron. Sept. 13.

13,893. H. Timmler. Annealing furnaces. Sept. 20.

13,925. J. F. Kester and F. A. Hecht. Self-fluxing solder. Aug. 23.

14,324. R. Fiedler. Process for silver-plating. Aug. 23.

14,592. H. Bumb. Mode of making alloys of magnesium. Sept. 20.

XI.—ELECTRO-CHEMISTRY and ELECTRO-METALLURGY.

Applications.

16,555. F. A. Gooch. Improvements in the reduction of aluminium by electrolysis. Complete Specification Aug. 15.

16,569. R. A. Katz. Improvements in accumulator electrodes. Aug. 15.

16,636. E. Placet. Improvements in electrical accumulator batteries. Complete Specification. Aug. 16.

16,690. J. Bryant. A new or improved composition for use as an electrolyte in batteries or cells. Aug. 17.

16,824. E. Grauer. Improvements in apparatus for electrochemical and electrothermic melting operations, especially for the production of calcium carbide. Aug. 18.

17,052. J. Y. Johnson.—From Chemische Fabrik vormals Goldenberg, Geromont and Co., Germany. Improvements in or connected with electric batteries. Aug. 22.

17,258. A. J. Boult.—From J. Trillet, France. Improvements in or relating to galvanic batteries. Complete Specification. Aug. 25.

17,261. H. Leitner. Improvements in secondary batteries. Aug. 25.

17,337. C. Vogt. An improved battery cell with double case. Complete Specification. Aug. 26.

17,410. R. Haddan.—From R. Goldstein, Germany. Improvements in electric accumulators. Aug. 28.

17,411. R. Haddan.—From R. Goldstein, Germany. Improvements in negative electrodes for electric accumulators. Aug. 28.

17,924. A. Rovello. A new or improved process and apparatus for electrolytically precipitating metals in the cementation vats. Filed 5th Sept. Date applied for 16th March 1899, being date of application in Italy.

18,005. R. N. Lucas and E. S. New. Improvements in secondary galvanic batteries or accumulators. Sept. 6.

18,100. R. Pearson. Improvements in electrical batteries. Sept. 7.

18,254. E. F. A. Polzin. Improved construction of accumulator plates. Complete Specification. Sept. 9.

18,350. Q. Marino. Improvements in or relating to electrolytes. Sept. 11.

18,438. C. V. Burton. Improvements in or relating to the electrolytic deposition of metals. Sept. 12

18,589. J. Greenwood. Improvements in the decomposition of alkaline salts by electrolysis and in apparatus therefor. Sept. 14.

18,643. F. H. Snyder. Improvements relating to the amalgamation and coating of metals or alloys of metals with metals or alloys of metals by the aid of electricity and to apparatus therefor. Sept. 15.

18,743. H. Leitner. An improvement in separators for the plates of secondary batteries. Sept. 16.

18,754 P. Meyer. Improvements in galvanic batteries. Sept. 16.

Complete Specifications Accepted.

1898.

18,958. E. Edser. Electrolytic decomposition of alkaline salts. Sept. 6.

19,445. H. Blumenberg, jun. Electric batteries. Sept. 20.

19,632. W. A. Crowdus. Secondary batteries. Sept. 6.

21,233. J. Thornton and T. R. Canning. Apparatus for coating metal articles by electro-deposition. Aug. 23.

21,835. W. J. Still. Storage batteries. Aug. 23.

1899.

8963. C. F. P. Stendebach and H. M. F. Reitz. Production of a filling paste or active material for the plates of secondary batteries. Aug. 23.

11,349. L. G. Leffer. Electrodes or plates for secondary batteries. Sept. 13.

13,826. L. Tobiansky. Elastic and permeable electrodes for storage batteries. Sept. 20.

14,794. S. Y. Heebner. Storage batteries. Aug. 23.

XII.—FATS, OILS, and SOAP.

Applications.

16,537. R. Hutchison. Improvements in treating oxidisable oils, such as linseed oil and maize oil, to obtain useful products and compounds. Aug. 15.

16,549. F. W. Golby.—From G. Heil, jun., Germany. Improved oil-saving apparatus. Aug. 15.

17,012. A. Euston. Improvements in apparatus for treating oleaginous seeds. Complete Specification. Aug. 22.

17,013. A. Euston. Improvements in hydraulic presses particularly adapted for extracting oil from oleaginous seeds. Complete Specification. Aug. 22.

17,014. A. Euston. Hydraulic press for extracting oil from oleaginous seeds. Complete Specification. Aug. 22.

17,638. J. Wetter.—From the firm of H. Schlinck et Cie., Germany. Improvements in the treatment of edible oils and fat to render them odourless and tasteless. Aug. 31.

17,685. F. Treu. Improvements in oil purifiers. Complete Specification. Sept. 1.

18,244. R. Hutchison. Improvements in making oleaginous or resinous compounds suitable for various useful purposes. Sept. 9.

18,439. A. Kürten. An improved washing and cleaning compound. Complete Specification. Sept. 12.

Complete Specifications Accepted.

1898.

19,294. F. Donati and F. Hornbostel. Lubricant. Aug. 23.

23,806. D. Gray, jun. Soap compound. Sept. 20.

27,234. D. F. Malézieux. Soap or cleansing material. Sept. 20.

1899.

13,119. G. A. F. Krumm. Cleansing composition or wash for linen and the like. Aug. 30.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS; INDIA-RUBBER, Etc.

Applications.

16,626. M. B. Grout and T. W. Moore. Improvements in composition of matter for repairing rubber tires and the like. Complete Specification. Aug. 16.

16,740. R. A. Parkin and G. G. Dickenson. Solution for mixing with paint applicable for increasing its bulk and helping to resist heat. Aug. 17.

16,805. R. R. Gubbins and H. Loog. Means for the recovery of rubber from waterproof cloth or cuttings thereof. Aug. 18.

17,244. G. von Reinolts. A new or improved preparation or compound to be used as a substitute for white lead in the preparation of paints. Aug. 25.

17,612. C. O. Weber and I. Frankenburg. Improvements in the recovery of waste rubber. Aug. 31.

17,655. O. Imray.—From W. V. McManus, United States. New manufacture of compound for mixing with caoutchouc. Aug. 31.

18,330. C. R. Gostling. Improvements in and relating to the manufacture of whiting. Sept. 11.

18,538. J. McLintock. An improved protective paint for ships' bottom and other steel-work. Sept. 14.

18,646. A. J. Willcox. Improved wood polishing liquids. Sept. 15.

Complete Specifications Accepted.

1898.

17,178. Matthews, Lancashire, Cheshire, and North Wales District White Lead Company, Ltd. S. Pope and G. V. Barton. Production of lead oxide, and in means or apparatus employed therein. Sept. 20.

17,478. C. Weygang. Siccative oils and varnishes. Aug. 23.

1899.

10,342. G. Wegelin. Process for the manufacture of soot, lamp-black, and the like of high specific gravity. Aug. 30.

14,069. R. W. James.—From G. D. Coleman, United States. Method of and means for the application of anti-fouling coating for metallic submerged structures. Sept. 6.

15,255. A. Gentszch. Manufacture of gutta-percha-like substances. Aug. 30.

15,310. A. P. Bjerregard. Process for the manufacture of varnish. Aug. 30.

15,847. H. W. N. Ahrens. Stirring device to overcome the formation of skins or films in the storing or keeping of lacquers, varnishes, oils, colours, and other substances liable to form a skin or film on the top. Sept. 6.

XIV.—TANNING, LEATHER, GLUE, and SIZE.

Applications.

17,412. E. Maertens. A new or improved leather and process and apparatus for manufacturing the same. Aug. 28.

17,479. C. E. Lappe and H. A. Lappe. Improvements relating to the manufacture and finishing of leather. Complete Specification. Aug. 29.

17,854. R. B. Arthur. An improved process for treating leather and similar substances. Complete Specification. Sept. 4.

18,199. H. E. E. Maillard. Improvements in glue or in the method of using same. Sept. 8.

18,755. F. W. Wartenberger. An improved combined tanning and dyeing process. Sept. 16.

Complete Specifications Accepted.

1898.

20,680. A. Rainard. Tannic extracts, and apparatus for the manufacture thereof. Sept. 6.

25,017. C. D. Abel.—From The Actiengesellschaft für Anilinfabrikation, Germany. *See* Class VI.

XV.—AGRICULTURE AND MANURES.

Application.

17,682. J. E. Jefferies. A chemical plant food and insecticide and the applications thereof. Sept. 1.

Complete Specification Accepted.

1899.

12,233. A. Wenck. Manufacture of artificial manure. Sept. 20.

XVI.—SUGARS, STARCHES, GUMS, Etc.

Applications.

16,578. L Haas and A. Grantzdorffer. Improvements relating to the crystallisation of sugar obtained from the by-products of sugar factories and to apparatus therefor. Aug. 15.

17,558. W. A. Morris. Purified gum in scales or flakes. Aug. 30.

17,821. A. Read. Improvements in the method of and means for the manufacture of sticks, bars, or rolls of boiled sugar, particularly of the kind having lettered or figured designs. Sept. 4.

17,925. L. Deproit. An improved product, designed for use as a substitute for glucose or gum used for industrial and alimentary purposes. Sept. 5.

Complete Specifications Accepted.

1898.

22,788. G. B. Ellis.—From F. Hornig, Germany. Treatment of spent beetroot, and production of a useful body therefrom. Sept. 6.

25,642. O. Imray.—From Ranson's Sugar Process, Ltd., France. Purifying and decolourising saccharine liquors. Aug. 23.

1899.

1035. C. F. Cross and J. S. Remington. Production of starch and saccharine matters. Sept. 20.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

16,486. A. Blackie. Improvements in the method of and apparatus for hop drying. Aug. 14.

16,521. F. J. Usher. A register to indicate the temperatures of malt during the various stages of drying and curing of same in connection with "King's patent automatic heat regulator." Aug. 15.

16,678. G. Souter and J. S. Souter. A new or improved method for the utilisation of distillers and brewers by-products. Aug. 17.

17,056. A. Kummer and H. Wittich. Improvements in or relating to brewing apparatus. Aug. 22.

17,100. C. Himmelspach. Improvements in and connected with brewing. Aug. 23.

17,482. F. Wrede and R. Bayer. Improvements in the production of compressed bakers' yeast. Aug. 29.

17,720. E. de Meulemeester. A rapid and complete process for extracting saccharification worts in brewing. Sept. 1.

Complete Specifications Accepted.

1898.

18,412. S. White and J. Sleeman. Methods of malting, drying, and otherwise treating grain and the like, and apparatus therefor. Sept. 6.

22,058. J. H. Fullarton. Disposal of distillery effluents. Sept. 20.

22,355. P. Kropf. Manufacturing beer. Aug. 23.

22,607. J. S. Hewitt. Purification of alcoholic liquids. Aug. 23.

XVIII.—FOODS, SANITATION, Etc., and DISINFECTANTS.

Applications.

A.—Foods.

16,966. B. Endler. A new or improved method of preserving eggs. Complete Specification. Aug. 21.

17,145. A. Gürber. An improved process for producing condensed milk. Complete Specification. Aug. 24.

17,926. L. Deproit. Alimentary product for use as a substitute for honey. Sept. 5.

14,927. L. Deproit. An improved alimentary product obtained by the mixture of saccharine or saccharine compounds and sugar. Sept. 5.

18,111. S. Gironcoli. An improved process of preserving meat and fish. Sept. 7.

18,426. L. L. Carpentier. An improved process for the preservation of butter. Sept. 12.

B.—Sanitation.

16,466. F. Ball. Improvements in furnaces for the destruction and incineration of ash-bin and other refuse. Aug. 14.

16,563. W. D. Scott-Moncrieff. Improvements in or relating to the bacterial purification of sewage. Aug. 15.

16,880. F. Tomlinson. Improvements in the purification of sewage and other foul liquids and water by biological means, and in the construction, arrangement, and working of filters for use therein. Aug. 19.

17,027. H. P. A. Gaillet. Improvements in apparatus for purifying and sterilising drinkable waters. Aug. 22.

18,061. W. D. Scott-Moncrieff. Improvements in relating to the bacterial purification of sewage. Sept. 7.

18,129. L. Hirt. Improvements in water - purifying apparatus. Sept. 7.

C.—Disinfectants.

16,475. C. E. A. Guerrette. A washing and disinfecting fluid. Aug. 14.

Complete Specifications Accepted.

A.—Foods.

1898.

21,284. H. Y. Castner. Method of purifying salt. Aug. 30.

1899.

4711. J. H. G. Neisse and J. H. Boll. Process for producing or treating margarine. Sept. 6.

14,006. R. R. Harvey. Production of organic extracts and serums of the blood containing organic ferments and their application to mammalian animals, principally for increasing the milk of dairy cattle and fattening stock, and for other purposes. Sept. 20.

14,288. H. A. Sévigné. Methods of preserving bread. Aug. 30.

B.—Sanitation.

1898.

16,767. D. B. Cumming. Destruction of distillery refuse. Sept. 13.

20,620. W. R. Hutton, jun. Process for the utilisation of precipitated sewage sludge. Aug. 30.

25,209. E. Pilous, G. Ottermann, and E. Nauheim. Method of producing gas from town refuse and sweepings, and apparatus therefor. Sept. 20.

C.—Disinfectants.

1898.

19,326. A. Zimmermann. Antiseptics and deodorisers. Sept. 13.

23,057. A. Zimmermann.—From the Chemische Fabrik auf Actien vormals E. Schering, Germany. Disinfecting by means of formic aldehyde. Sept. 6.

25,139. J. M. L. Messerli née Imbert. Process for producing gases and vapours for fumigating purposes, and apparatus therefor. Sept. 13.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

16,870. A. Robinson. Improvements in the manufacture of pulp or glutinous material from vegetable products. Aug. 19.

17,401. W. C. Leechmann. Improvement in transparent paper. Aug. 28.

17,637. E. Milo and E. J. Richardson. Process for the manufacture of materials having the appearance of mother-of-pearl, malachite, marble, lapis, lazuli, or other ornamental objects. Aug. 31.

17,883. A. J. Küppers. Process for the production of odourless and tasteless water and air-tight paper. Sept. 5.

18,031. J. Westaway. A new or improved apparatus for compressing and embossing leather and other pulp. Sept. 6.

18,032. J. Westaway. A new or improved process and apparatus for compressing fibrous pulp or other similar material into articles of various shape. Sept. 6.

18,033. J. Westaway. New or improved means for making, shaping, and moulding by compression articles of various forms with the aid of fibrous or ligneous pulp. Sept. 6.

18,034. J. Westaway. New or improved means for producing embassments in cameo or in intaglio in fibrous pulp. Sept. 6.

18,035. J. Westaway. A new or improved process and composition of matter for making artificial ivory, bone, and the like. Sept. 6.

18,148. W. C. Parkin, A. Williams, and H. Kitchin. A new composition for knife handles and other purposes. Sept. 8.

Complete Specifications Accepted.

1898.

22,674. E. Bush. Machinery for varnishing and otherwise coating continuous paper or other material. Sept. 6.

1899.

7438. A. von Feszty.—From Phragmites Communis. Process for manufacturing paper pulp from the root refuse of common reed. Sept. 6.

11,275. C. Wurster. Machines for pulping up paper and paper materials. Sept. 20.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Applications.

16,942. J. Provoyeur. Improvements in or relating to vegetable extracts. Aug. 21.

17,840. A. Zimmermann. Improvements in perfumery. Sept. 4.

17,934. S. S. Bromhead.—From Chemische Fabrik Helfenberg Actien Gesellschaft, formerly E. Dieterich, Germany. Process for the production of bromide of albumen, bromide of peptone and albuminous or peptonous derivatives of bromine. Complete Specification. Sept. 5.

18,319. B. Willcox.—From The Badische Anilin and Soda Fabrik, Germany. Improvements in the manufacture of anthranilic acid. Sept. 11.

18,334. F. Raschig. Process for the separation of metacresol and paracresol. Complete Specification. Sept. 11.

Complete Specifications Accepted.

1898.

20,801. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of new compounds containing halogen. Aug. 23.

21,471. W. Pip. Process for the preparation of piperidine and dihydrochinoline. Sept. 13.

21,756. O. Imray.—From The Farbwerke vormals Meister, Lucius, and Bruning, Germany. Manufacture of a substance for raising the pressure of the blood. Aug. 23.

23,254. A. Strebel. Manufacture of ionone from citral and acetone, and of cyclocitral as intermediate product. Sept. 6.

26,639. E. Kauder. Process for producing methylmorphine (codeine) and ethyl-morphine. Sept. 20.

XXI.—PHOTOGRAPHY.

Applications.

17,098. J. Meyer. A new or improved process of producing photographic films. Complete Specification. Aug. 23.

17,165. J. E. Thornton and C. F. S. Rothwell. Improvements in transparent photographic films, and in the manufacture thereof. Aug. 24.

17,215. J. E. Thornton and C. F. S. Rothwell. Improvements in the method, means, and apparatus for coating photographic paper films and the like, and in the manufacture of photographic materials. Aug. 24.

17,292. J. E. Thornton and C. F. S. Rothwell. Improvements in photography and connected with the operations of developing and fixing. Aug. 26.

17,293. J. E. Thornton. Improvements in relation to stereoscopic photography. Aug. 26.

17,375. F. J. Farrell and E. Bentz. Improvements relating to the production of photographs on silk. Aug. 28.

17,446. J. E. Thornton and C. F. S. Rothwell. Improvements in photographic films. Aug. 29.

17,522. A. G. Adamson. Improvements in apparatus for photography by means of gas. Complete Specification. Aug. 30.

18,738. O. Moh. Improvements in or relating to photographic films. Sept. 16.

Complete Specifications Accepted.

1898.

16,959. A. J. Boult.—From E. Goldschmid, Germany. Method of producing photographic pictures. June 21.

1899.

243. W. F. Crawford. Apparatus for the mechanical treatment of photographically prepared surfaces during the developing and finishing processes. Aug. 30.

11,553. J. F. Guimaraes. Intense lighting apparatus for instantaneous photography called a Relampago Guimaraes. Sept. 20.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

16,564. W. A. E. Crombie. Improvements in the production of nitro-cellulose. Aug. 15.

16,595. C. H. Curtis and G. G. André. Improvements in explosives. Aug. 15.

16,596. J. Karstairs. Improvements in explosives and in the manufacture of same. Aug. 16.

16,631. T. Jowett. A new or improved explosive especially applicable for use in detonating fog signals. Aug. 16.

17,961. C. Aldridge. Improvement in safety matches. Complete Specification. Sept. 5.

18,516. S. Fülöp and M. J. Lackovic. Improved manufacture of blasting composition. Sept. 13.

Complete Specifications Accepted.

1898.

18,935. J. Okell.—From H. Pipitz, Austria. Manufacture of explosives. Aug. 30.

19,039. S. A. Rosenthal and S. J. von Romacki. Manufacture of matches capable of being struck anywhere without yellow phosphorus. Sept. 6.

20,449. C. Kastner. Matches. Aug. 30.

22,398. H. S. Wilson and W. G. Wilson. Fuses, and apparatus for setting the same. Aug. 30.

22,438. A. T. Dawson and J. Karstairs. Explosive charges for ordnance. Aug. 23.

22,535. Sir W. G. Armstrong, Whitworth, and Co., Ltd. Sir A. Noble, and G. Stuart. Time fuses. Aug. 30.

1899.

11,051. H. P. Hurst. Safety fuses or detonators for explosive projectiles and their fittings. Sept. 6.

XXIII.—ANALYTICAL CHEMISTRY.

Applications.

17,150. W. S. Webster and The Dairy Outfit Company, Ltd. Improvements in fat-testing instruments for milk and milk products. Aug. 24.

17,625. W. S. Webster and The Dairy Outfit Company, Ltd. Improvements in centrifugal apparatus for butyrometers and other fat-testing instruments, and for like purposes. Aug. 31.

PATENTS UNCLASSIFIABLE.

Applications.

17,428. O. Imray.—From R. Hartleb, Germany. Culture of bacteroids from leguminous bacteria. Aug. 28.

17,505. F. H. A. Wielgolaski. An improved method of separating finely divided or finely divided and dissolved substances of different specific weights from liquids. Complete Specification. Filed Aug. 29. Date applied for, Jan. 30, 1899, being date of application in Sweden.

17,657. A. Spitteler. Process for obtaining clear solutions from impure paranucleoproteids. Aug. 31.

Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—p. 7979.

THE JOURNAL

OF THE

Society of Chemical Industry.

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 10.—Vol. XVIII.] OCTOBER 31, 1899. [Non-Members 30/- per annum; Members 21/- per Set of extra or back numbers; Single Copies (Members only) 2/6.

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S. P. Eastick	I., III., XI., XIX.
Thos. Ewan, Ph.D.	Gen. Chem.
J. E. Halstead	V., VI.
H. Ingle, Ph.D.	IV., V., VI.
J. B. C. Kershaw	VII., XI.
S. Kleemann, Ph.D.	IV., VI., XIII., XX.
T. A. Lawson, Ph.D.	IV., XX.
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J. McCrae, Ph.D.	IV.
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G. H. Robertson	XI.
Chas. Salter	I., II., III., XV., XVI.
R. Sandon	II.
H. H. B. Shepherd	IX.
J. Shields, D.Sc., Ph.D.	XI.
A. Shonk	Gen. Chem.
W. P. Skertchley	XII., XVIII., XX.
E. Sonstadt	III., VII., X.
A. L. Stern, D.Sc.	XVII.
E. Howard Tripp, Ph.D.	III., VII., XVI.
V. H. Veley, M.A., F.R.S.	Gen. Chem.
C. Otto Weber, Ph.D.	IV., XIII.
L. J. de Whalley, B.Sc.	XVI.
E. W. Wheelwright, Ph.D.	XXII.
A. Wingham	X.
Joseph T. Wood	XIV.
A. C. Wright, B.Sc., M.A.	IV., XVIII., XX.

Liverpool Section.

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Vice-Chairman: Charles A. Kohn.

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A. Carey.
Herbert E. Davies.
D. Herman.
C. L. Higgins.
E. K. Muspratt.
Max Muspratt.
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H. de Mosenthal.
Walter F. Reid.
A. Gordon Salamon.
T. Tyrer.
Frank Wilson.

Hon. Local Secretary:
A. R. Ling, Laboratory, 2, St. Dunstan's Hill, E.C.

SESSION 1899—1900.

Monday, Nov. 6th.—Mr. Walter F. Reid, F.I.C., F.C.S. "On 'Velvril' Material, a New Substitute for India-rubber and Gutta-percha."
(The title given last month was not that of the author.)

Monday, Dec. 4th.—Mr. Sherard Cowper-Coles, Assoc. M.I.C.E., M.I.M.E., M.I.E.E. "The Fireproofing and Preserving of Timber."

Manchester Section.

Chairman: D. Watson.

Vice-Chairman: J. Grossmann.

Committee:

G. H. Bailey.
F. H. Bowman.
W. Brown.
H. Grimshaw.
J. M. Irving.
M. J. Langdon.
I. Levinstein.
A. Liebmann.
A. K. Miller.
F. Scudder.
Edw. Schunck.
C. Truby.

Hon. Local Secretary:
J. Carter Bell, The Cliff, Higher Broughton, Manchester.

SESSION 1899—1900.

Friday, Nov. 3rd.—Dr. J. Grossmann. "The Limits of Accuracy in Technical Analysis."

Newcastle Section.

Chairman: N. H. Martin.

Vice-Chairman: F. S. Newall.

Committee:

A. Allhusen.
P. P. Bedson.
G. T. France.
T. W. Hogg.
H. Louis.
H. S. Pattinson.
John Pattinson.
W. W. Proctor.
W. L. Rennoldson.
G. Sisson.
J. E. Stead.
J. K. Stock.

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New York Section.

Chairman: T. J. Parker.

Vice-Chairman: Clifford Richardson.

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H. Clementson.
V. Coblentz.
B. B. Goldsmith.
J. Hartford.
J. Hasslacher.
E. G. Love.
R. W. Moore.
C. E. Pellew.
G. A. Prochazka.
Max. Toch.
S. A. Tucker.

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Chairman: F. Stanley Kipping.

Vice-Chairman: J. O'Sullivan.

Committee:

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S. F. Burford.
F. J. R. Carulla.
R. M. Caven.
H. Forth.
W. Scott Herriot.
J. F. Kempson.
J. M. C. Paton.
A. L. Stern.
J. J. Sudborough.
S. Trotman.
G. J. Ward.

Hon. Treasurer: S. J. Pentecost.

Hon. Local Secretary:
J. T. Wood, 29, Musters Road, West Bridgeford, Nottingham.

SESSION 1899-1900.

Wednesday, Nov. 29th, at 7 p.m., at Derby.

Scottish Section.

Chairman: G. G. Henderson.

Vice-Chairman: A. P. Aitken.

Committee:

W. Carrick Anderson.
E. M. Bailey.
G. T. Beilby.
A. C. J. Charlier.
J. Christie.
John Clark.
C. J. Ellis.
C. A. Fawsitt.
W. Foulis.
W. Frew.
R. A. Inglis.
Robt. Irvine.
A. D. Ker.
J. B. Readman.
E. C. C. Stanford.
R. T. Thomson.

Hon. Secretary and Treasurer:
Thomas Gray, Technical College, 204, George Street, Glasgow.

SESSION 1899—1900.

Tuesday, Nov. 21st. Glasgow.—Dr. W. Carrick Anderson. "Recovery of Nitrogen in Coal Distillation."

Tuesday, Dec. 19th. Glasgow:—
Mr. Alfred Chiddey. "The Cyanide Process at Yalwal, N.S.W."
Dr. Jno. Clark. "A Method for the Analysis of Copper."

Yorkshire Section.

Chairman: Christopher Rawson.

Vice-Chairman: George Ward.

Committee:

J. E. Bedford.
F. W. Branson.
H. K. Burnett.
A. W. Cooke.
T. Fairley.
W. M. Gardner.
Edw. Halliwell.
J. J. Hummel.
W. McD. Mackey.
H. R. Procter.
G. W. Slatter.
Thorp Whitaker.

Hon. Local Secretary and Treasurer:
H. R. Procter, The Yorkshire College, Leeds.

NOTICES.

Collective Index.

The Collective Index (1881—1895) is now ready. The prices are as follows:—

To Members and Past Members; Libraries, Societies, and Exchanges on the Society's List	Each copy	10*s.*
To Subscribers	„	12*s.* 6*d.*
To others	„	15*s.*

Excursion to Paris.

As arranged at Newcastle in July last, it is proposed to hold the next Annual General Meeting in London, and then to adjourn to Paris. The visit will be so timed as to coincide with the Meeting of the International Congress of Applied Chemistry, which will be held in Paris from the 23rd to the 31st July, and to which the Council has agreed to send delegates. It will also afford an excellent opportunity of visiting the International Exhibition. Ladies may accompany members as usual upon such occasions.

Having regard to the large numbers who are expected to visit Paris next summer, it is imperatively necessary to secure hotel accommodation some months beforehand; and in order to do this, the Council must have some indication of the numbers for which it would have to provide.

When data have been obtained from which some estimate of the cost may be made, the Council will communicate further with those who fill up and return the annexed form to the General Secretary. This should be done not later than November 30th next.

Notice is hereby given, for the information of members and advertisers, that the advertisement columns of this Journal have been contracted for by Messrs. Eyre and Spottiswoode, the Society's printers and publishers, to whom all communications respecting them should be addressed. The circulation of the Journal is now more than 3,500 per month.

LIST OF MEMBERS ELECTED 23rd OCTOBER 1899.

Alsop, Wm. K., 30, Ferry Street, New York, U.S.A., Chemist.

Althouse, C. Scott, 315, West 6th Street, Reading, Pa., U.S.A., Student.

Arnolt, G. W. Campbell, 1479, Bedford Avenue, Brooklyn, N.Y., U.S.A.

Ballantyne, Jno. C., 47, Gorst Road, Wandsworth Common, S.W., Analytical Chemist.

Bridge, George E., 128, Old Christchurch Road, Bournemouth, Chemist and Druggist.

Brown, Wm. J., 33, Gladstone Street, Leven, Fife, N.B., Chemist.

Calvert, Sidney, State University, Columbia, Mo., U.S.A., Professor of Chemistry.

Dewez, Eugene, jun., Herve, Belgium, Tanner.

Dudderidge, Frank R., 55, Northumberland Street, Newcastle-upon-Tyne, Teacher of Chemistry.

Du Vivier, Ernest H., 441, West 21st Street, New York City, U.S.A., Chemist.

Fingland, Jno. Jas., Minas de Aznalcollar, Prov. de Sevilla, Spain, Analytical Chemist.

French, H. Hutchins, Florenceville, Grove Road, Sutton, Surrey, Produce Broker.

Fuller, Wm., 8, Orchard Road, Blackheath, S.E., Chemist.

Gutcher, Wm., Singapore Oil Mills, Singapore, S.S. Superintendent Engineer.

Haworth, Dr. Edw., 6, Stanley Villas, Runcorn, Cheshire, Chemist.

Jerdan, Dr. David S., c/o J. and G. Cox, Ltd., Gorgie Mills, Edinburgh, Chemist.

Lloyd, Chas., 77, Bishopsgate Street Within, E.C., and (Journals) c/o Manager, Lake View Consols, Ltd., Boulder, Western Australia, Secretary.

Lynn, R. Rankin, 7, Highburgh Terrace, Dowanhill, Glasgow, Science Student.

Miller, Chas. E., 6, Gibson Street, Hillhead, Glasgow, Chemist.

Murphy, Albert J., The Laboratory, 11, Lyddon Terrace, Leeds, Brewer's Chemist.

Neale, Harry A., Owens College, Manchester, Chemist.

Paessler, Dr. Joh., Vorstand der Deutschen Versuchsanstalt für Lederindustrie, Freiberg in Sachsen, Chemist.

Rink, Arnold, 9, Butler Street, Milton Street, London, E.C., Tannin Extract Manufacturer.

Roscow, Wm., 72, Blackstone Avenue, Pawtucket, R.I., U.S.A., Analytical Chemist.

Shero, Jno. E., c/o Pittsburgh Reduction Co., Niagara Falls N.Y., U.S.A., Chemist.

Smith, John, Ducie Street, Piccadilly, Manchester, Chemical and Oil Merchant.

Stevenson, Arnold, 4, Porchester Gardens, London, W., Chemist.

Sundstrom, Carl, c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.

Teas, Wm. Holmes, c/o U.S. Leather Co., 30 Ferry Street, New York City, U.S.A., Chemist.

Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M. Inst. C.E., Gas Engineer.

CHANGES OF ADDRESS.

Australian Institute of Mining Engineers, l/o Box 102; 60, Market Street, Melbourne, Victoria.

Barlow, Clinton W., l/o 96; 103—105, Greene Street, New York, U.S.A.

Bennie, J. W., l/o London; Mountain Copper Co., Keswick, Shasta Co., Cal., U.S.A.

Burgess, W. T., l/o Reigate; 46, Portland Road, Holland Park, W.

Chemical and Metallurgical Society of South Africa, l/o 2596; Box 4375, Johannesburg; and retain Journals until further notice.

Driessen, Dr. P. Aug., l/o Norwich, U.S.A.; Leyden, Holland.

Fletcher, A. E., l/o Caterham; Coombe Lea, Dorking, Surrey.

Gardiner, H. J., l/o Clapton; 22, Chatham Place, Hackney, N.E.

Hogg, Quintin, l/o Rood Lane; 61, Threadneedle Street, London, E.C.

Hunt, B., l/o Palmerston; Eureka G. M. Co., Ltd., Port Darwin, Northern Australia.

Jameson, A. H., l/o South Chicago; Logan Manufacturing Co., Phœnixville, Pa., U.S.A.

Labonde, Dr. L., l/o Newark, U.S.A.; Los Angeles, Cal., U.S.A.

Lawson, Dr. T. A., l/o Alexandra Road; 90, Boundary Road, N.W.

Neil, J. Millar; Journals to c/o Barrington and Holt, Carthagena, Spain, Manager, Subida Iron Co.

Newcomen, Thos., l/o Stroud; Sunnybank, Coleford, Gloucestershire.

Peppel, S. V., l/o Leetonia; 215, Murray Street, Madison, Wis., U.S.A.

Pullar, Sir Robt.; Journals to Free Library, Perth, N.B.

Robertson, J. R. H., l/o Panama; Dunire, Uddingston, Glasgow.

Shishkoff, W. A., l/o Simbirsk; Government Gold-melting Laboratory, Tomsk, Siberia.

Smith, Edgar F., l/o Ampthill Square; c/o E. M. Robson, Trelawny, Fairfax Road, Bedford Park, W.

Smith, Fred., l/o Johannesburg; c/o R. H. Kenningham, 91, Beverley Road, Hull.

Thornton, Wm., l/o Glasgow; c/o Veraguas Mining Co., El Remance, Santiago de Veraguas, Rep. of Colombia, South America.

Trench, G., l/o Faversham; Pilton Villa, Herne Bay, Kent.

CHANGES OF ADDRESS REQUIRED.

Brooke, S. W., l/o South Hill, Manningtree.

Isaac, J. F. V., l/o 114, Marine Parade, Brighton.

Deaths.

Castner, Hamilton Y., of Oldbury, at New York. Oct. 12.

Whitelaw, T. N., 87, Sydney Street, Glasgow.

Liverpool Section.

Meeting held on Wednesday, October 4th, 1899.

MR. ALFRED SMETHAM IN THE CHAIR.

HURTER MEMORIAL LECTURE.

The Chairman, in opening the meeting, said: We are gathered together this evening, at the opening meeting of the last complete session of the century, under conditions unique in the history of this Section and of the Society at large. The custom has been for the Chairman to deliver an address or read a paper. To-night, as you are aware, we are departing from the usual course, and are assembled with the twofold object of doing honour to the memory of one of the most brilliant members and staunchest supporters of the Society, and of listening to a lecture by one of the foremost exponents of technical chemistry of the age.

Under these circumstances, it is with mingled feelings of pain and pleasure that I am constrained to bring to your notice, in as brief a manner as possible, a *résumé* of the circumstances which have culminated in our meeting to-night.

Young as the Society is—only 18 years old—we have, unfortunately, to mourn the loss of some of the most prominent and active of our members. Among those of our own Section who have passed over to the great majority none can claim a higher regard than Dr. Ferdinand Hurter, who, after a too brief life of usefulness, died when at the very zenith of his fame. Of him and his work it will scarcely be necessary for me to remind those of our members who have been in the habit of attending our Liverpool meetings. His genial presence, his humility—the humility of true greatness—his loveableness, his flashes of genius so characteristic of the man, are too well remembered by all of us who had the privilege of knowing him and meeting him; but, for the benefit of those who were not so fortunate, I may, perhaps, be permitted to give in brief outline some of the salient characteristics of the notable figure in whose memory the inaugural lecture of to-night is to be given. Spare in form, with the student's stoop—begot, I fear, of a too persistent devotion to duty—a quickly awakening glance of intelligence when a new subject was broached, and a rapt attention to the subject under discussion, constituted what was most prominent to the casual observer at our meetings. A more careful observation soon discovered the fact that it was no common type of man who listened to and criticised the papers which were from time to time read before the Society. But when—and the instances were not few—he himself entered the arena and gave expression to one of his masterpieces—those classical papers of which the Society may so justly be proud—then, indeed, it became evident that he was a very giant among his compeers, and everyone present felt the spell of his power. To those who knew him better a fuller revelation of his greatness was to be found in the simplicity of a noble life, which was ever ready to sacrifice itself, if, by so doing, it could add, even to the smallest extent, to the happiness or advancement of the youngest aspirant to scientific fame; while he spared no pains to assist those who came to him after being weather-tossed in the harsh tempests of disappointment by the failure of cherished processes applied in practice. It mattered little to him whether applicants for his advice and wise counsels were young or old, so long as the struggle in which they were engaged was that of sincere striving after truth, and then thoughts of self-interest sank into insignificance before the one overwhelming desire to serve a struggling brother. If it be true that "the evil which men do lives after them," it is also true that good, in science at all events, is equally permanent, and not only will the published work of Dr. Hurter have a lasting effect in moulding the destinies of manufacturing chemistry, but the more subtle influence of a noble example will make itself felt in circles ever widening to the marge of time.

Of Dr. Hurter's work it is not here my province to speak. A very able summary of his published papers and general scope of his investigations has already appeared in the Journal of the Society, and it would be a work of supererogation to attempt to add to that admirable paper. What to my mind claims for him the grateful recognition of this Society is the fact that he has shown the way of bringing the exactitude of the laboratory to bear upon investigations in the works, and that from beginning to end his work has been of an essentially practical character. In this respect he was an ideal member of a Society which has for its chief aim the advancement of the Science of Chemical Industry.

Much of Hurter's work has been expressed in his published papers, much is revealed in improved processes, but no publications could adequately express the man. His was an individuality which made itself felt directly you came into contact with him, and not to have known him—not to have fallen a victim to that magic spell—was to lose half the grandeur of his life. Thus it came about that when, on March 12th, 1898, Death's chill hand had touched him, and the first shock of the irreparable loss to this Section of the Society was over, a spontaneous and unanimous desire at once made itself manifest to do something by which a memory so dear to us might be perpetuated in some tangible form.

After much thought and deliberation by the Committee in Liverpool, and by the Council of the Society at large in London, it was decided that the most fitting way in which we could do honour to Dr. Hurter was to institute a memorial lecture, to be given at intervals in that Section of the Society which had claimed so much of his time, and for which he had worked so assiduously. Hence it has come about that we are met together to-night to listen to the first Hurter Memorial Lecture, delivered by one who is, in his work and aims, closely allied to Hurter, and who, perhaps more than any living man, is able to appreciate his work, and is a foremost example of the spirit which was in Hurter.

I need not introduce the lecturer to you. He and his work are famous throughout the manufacturing world, and I therefore simply call upon Professor Lunge to deliver his lecture.

IMPENDING CHANGES IN THE GENERAL DEVELOPMENT OF INDUSTRY, AND PARTICULARLY IN THE ALKALI INDUSTRIES.

BY PROF. GEORGE LUNGE, PH.D., OF THE POLYTECHNICUM, ZÜRICH.

The task which has been imposed upon me, to deliver the first of the newly-established Hurter Memorial Lectures, is as honourable as it is difficult. I speak before an audience which has been accustomed to listen to Dr. Hurter's lucid treatment of all questions coming within his reach, to his thorough mastery of the scientific facts underlying technological problems, and to his equally extensive acquaintance with the practical side of such questions. One who is personally known to but a very few in this room has to recall Hurter's memory before a number of men who had the privilege of constantly meeting and communing with that sympathetic personality that has passed away very much too early, whether we regard his numerous friends, or the welfare of British chemical industry, or the advance of scientific technology all over the world. Still I have some little claim to appear in this place. I knew Hurter, who was my junior by five years, for fully 30 years, and we were associated as joint authors of the English edition of the Alkali Makers' Handbook. We both sat as students at the feet of Bunsen and Kirchhoff, although not at the same time; and in the Zürich Polytechnicum, where Hurter received his first scientific education, I have taught technological chemistry for nearly 24 years. Our work has been mainly in the same departments of applied chemistry; we both came to England, as offering at that time more scope for a technical chemist than our own countries, at about the same period of our lives, Hurter in 1867, myself in 1864. Both of us found in this country what we sought—an open field for our abilities, such as they were, and very much to learn from the accumulated experience, not merely of great inventors, but also from that of modest "practical men." The "rule of thumb" had its sway at that period much more than at present, and with more justification. The bridge between theory and practice in the chemical arts was then nothing like so wide as it is to-day, and Hurter was one of those who contributed in a marked degree to enlarging that bridge, and putting it upon more solid foundations.

Both of us found a most generous welcome in this country, and none of the spirit of looking down upon the foreigner as an "Uitlander," with the result that we both selected England as our permanent home. If in my case this connection lasted only 12 years, whilst in Hurter's it was never broken, this was but the result of accidental differences in our personal situations.

In contrast with those links connecting me with Dr. Hurter, both in external circumstances and in the main purpose of our life-work, some of my hearers may remember that there was more than one lively discussion between us in the pages of chemical periodicals, including the Journal of this Society. But although we were not always agreed upon the way of looking at technical questions, this never interfered with our mutual esteem or with our personal intercourse. Witness to this is not merely our joint authorship of the English edition of the "Alkali Makers' Handbook," but, for instance, an extremely kind and sympathetic letter which Hurter wrote me in December 1897, on learning that I had had temporarily to give up my work owing to bad health. And precisely during the time when one of those controversies was going on, I exerted myself (and that not for the first time) to recommend him for a professorship of technological chemistry then vacant, as the best candidate I could propose. It will be hardly necessary to say more about the estimation in which I held both Hurter's attainments and his personality.

I shall, however, not attempt to enter upon this in detail. Last year, this Section listened to a description both of Hurter's personality and of his work, drawn up by those best qualified for the task, and I do not feel that I could contribute anything else to that subject worthy of this occasion, except a remark upon one side of Hurter's methods, not altogether neglected in that paper, but perhaps not brought forward with sufficient emphasis. I mean the mathematical equipment which Hurter possessed to a degree very uncommon among chemists (except physical chemists), and still less common among technical chemists. This is all the more remarkable, as he had no opportunity, or, at least, no inducement, for learning higher mathematics whilst studying at Zürich, nor, most probably, at Heidelberg. His having acquired higher mathematical knowledge later on by private study, and in the restricted leisure left him by a technical career, is evidence both of a special gift in that direction, and of extraordinary energy. It is unnecessary to say how important a thorough command of mathematical methods is, at a period when science is stepping from the stage of empiricism into that of theoretical mastery of its foundations; and this, on the Continent at least, is recognised by making a certain knowledge of higher mathematics compulsory for the education of chemists at the polytechnic schools, whilst at the universities it is as yet confined mostly to those who cultivate physical chemistry. Of course, there is a wide step from merely obtaining a grounding in the elements of the differential and integral calculus, to acquiring such a mastery over this discipline as to enable the student to apply it to the solution of scientific problems, and this step is as yet *not* made by the great majority of the students at German, French, or Swiss chemical schools, always excepting "physical chemists." It is also true that our insight into the nature of purely chemical reactions is, up to the present, too incomplete to admit of their mathematical treatment in more than a few cases, and that even in elementary cases this mostly needs a greater amount of higher mathematics than our polytechnic chemical students acquire in their curriculum, or than can be acquired by accidental private study even by men of Hurter's stamp. Nor can it be denied that mathematics are a double-edged weapon, in so far as they may tempt an observer to develop a theory on some class of phenomena only on that side which is susceptible of mathematical treatment, and, by neglecting other equally important sides of the case, to arrive at wrong conclusions. But although, on these grounds, it may still be called premature to attempt mathematical theories of such complicated problems as are offered by the cases coming under the cognizance of technical chemists, and although, as a matter of fact, the practice of technical chemistry has not as yet been sensibly advanced by any such theories, we must consider it certain that at some future period those chemists, including technologists, who cannot handle the calculus as we now handle the rule of three, will be left behind in the race. Nobody can at present tell how soon that period may arrive, and it is only right to equip the student with at least the foundation of higher mathematics, so as to enable him to build upon this later on, without an effort possible only to such exceptional master minds as Hurter's. And if even he did not, perhaps, succeed in turning his mathematics into something immediately useful for factory service, this does not diminish our admiration for his courage in applying himself to that task; a courage not shared by any of his technological, and by an extremely small number of his purely chemical, brethren. Surely, he who dreads the water will never learn to swim, and Hurter will always be looked upon as one of the pioneers in the application of mathematics to problems of technological chemistry, and therefore in the establishment of a true scientific basis for manufacturing chemistry.

His mathematically-trained mind also enabled him, in the intervals of practical occupations, and at a period of life when most of us have lost the freshness and easy learning power of youth, to acquire a thorough knowledge of physical chemistry, and also of electro-chemistry, which he had at first not been inclined to treat as a promising field for the technical chemist. It is characteristic of Hurter that, when he had once recognised the importance of electro-chemistry, he threw himself into that domain with as much ability as energy, and made contributions even to its theoretical side, although his situation as chemist to a private firm prevented him from publishing the results of his work as far as manufacturing interests were concerned. Nor was sufficient time granted to him for maturing the fruits of his labour, and that is one of the many reasons for which we must regret his early death.

The zeal which Hurter latterly developed in the cause of electro-chemistry is one of the cases in which he overcame a certain tendency to conservatism in technological questions —a tendency which he evidently acquired through his British associations. The British mind mostly clings to what it has found right and suitable for itself as long as possible, and generally prefers to make improvements in details rather than to strike out or even to follow entirely new paths, until this is quite unavoidable. Of course you may point to the great inventions made by Britons in all domains, and most certainly also in that of technical chemistry. But the majority of revolutionary inventions have not been made by specialists. Bessemer was a brass-founder, Thomas a War Office clerk, Weldon a journalist, Henry Deacon was an exception, and Hurter's invaluable aid in the working-out of the Deacon chlorine process is evident to all. Here, just as in the case of the vitriol-chambers, of the coke-towers, and other forms of apparatus or processes, the bent of Hurter's mind was always to prove the good side of what he found established by manufacturing practice, and to support this by the help of scientific weapons, which neither his friends nor his opponents could wield, and which sometimes were, perhaps, too fine for the broad questions at issue. But who can doubt that, if more time had been granted to him, he, who had himself invented or helped to invent so many important improvements in details of the alkali and chlorine industry, would have turned his mind also to bolder innovations, which he was bound by his special duties to scrutinize with all severity, and which he generally regarded at first with some suspicion. Just as he changed his mind in the matter of electro chemistry, he would have been open to do so in other fields as well, as, for instance, in that of the manufacture of sulphuric acid.

I cannot help expressing my regret that Hurter was not enabled to escape the trammels of his business position, which, whilst it gave him a wide scope for enlarging his experience in practical matters and for making experiments on a large scale, on the other hand imposed upon him the obligation of keeping secret just the most interesting results of his labours, and of confining his chemical work to a somewhat restricted domain. I know of absolutely no one in our generation who would have been as fit as Hurter in his mature years, after collecting his wonderful store of practical knowledge, to turn this to account in the laboratory of a scientific institution, where he might have worked as he wished, and trained pupils in his way, and where his great abilities would have been developed, not for the pecuniary benefit of some firm or other, but for the cause of chemical technology at large, and thus for the benefit of all mankind. True, at the present time he could not have found a place worthy of himself in this country, where, to my knowledge, there are hardly any full professorships of technological, physical, or electro-chemistry, such as exist in goodly numbers in some continental countries. But Hurter's personality might easily have induced one of the generous benefactors, fortunately not rare in Great Britain, to establish a professorial chair of that kind, in order to fill it with such a worthy first occupant, if he had only been spared to us a little longer. Knapp, Bolley, Emile Kopp, Bunte, Häussermann, Witt, and other eminent German and Swiss professors of chemical technology, spent a long time in manufacturing practice before being appointed to their chairs. In their respective countries they had not to wait for some private benefactor, but they found suitable posts provided for them by the State.

It is a broad question which is the better system; that which places both the pecuniary provision for the highest education of young men and the regulation of the plan of education itself in the hands of the State, or that which leaves these matters for private initiative, and to corporations or boards of governors representing voluntary contributors. Of course both systems have their advantages as well as their drawbacks, but it can hardly be denied that the voluntary system is more liable to leave gaps of the kind which I have mentioned.

But it is now time for me to turn from considerations of a personal character to a contemplation of the general features of those industries with which Hurter was identified, and to say a few words on their present state and on their immediate future, so far as it is safe to foretell the latter.

I shall mainly occupy myself here with a general question common to most industries, but particularly important for chemical works, *viz.*, that of fuel and of other sources of power. The time is long past when it might be called a fad of some croakers to speak of the comparatively near exhaustion of our coalfields. It may be, and probably is, an exaggeration to dread such a thing for the next generation or two. But at a time when the yearly output of coal in Great Britain has already exceeded 200 million tons, when that of the United States will undoubtedly outrun the above within a short period, and when there is no sign of a ceasing progression in the total output, we may well turn and consider how this is to end; whether that end may come in 50 years, or in a century or two? One thing is certain: the superiority in many industries which some countries, and most notably Great Britain, possess on the strength of their natural wealth in fossil fuel is only a question of time, and in some cases of a comparatively short time. The United States will hold out longer in that respect than any European nation, in consequence of their immense area of coal-bearing strata. The reserves of coal known to exist elsewhere, for instance, in China, will naturally be opened out long before any real dearth of coal is felt in Europe, but the great cost of carriage will, in the majority of cases, make that coal too dear, except for the finer industries, and for domestic purposes. This must needs lead to a shifting of the centre of gravity for the great coal-consuming industries, among which, if we include metallurgy, the chemical ones stand foremost. The situation becomes more complicated through the necessary exhaustion of other important raw materials, *e.g.*, iron and other ores, and through the discovery of new stores of these in various places, but so much is certain, that enormous changes are impending in this respect, not in the present but in a future undoubtedly less remote from our times than the past, when the Hansetowns possessed the monopoly of providing England with German iron and steel from their London "Stahlhof," and when the exportation of these articles from England was a crime subject to the severest legal penalties.

The shifting of the present equilibrium among industrial nations will be accelerated by other factors; we need not indulge in more or less uncertain prophecies, but we are faced by actual facts, in the two words: electricity and water-power. All that store of energy which millions of years have left upon our hands in the shape of fossil fuel, and which, of course, is an infinitesimal fraction of the energy of the solar rays reaching the earth during that period, is a trifle to that which the sun expends daily and hourly by the evaporation of water, and which is to a great extent transformed into the kinetic energy of falling water. But a few years ago, only a small portion of the water-power existing even in the most industrially developed countries was practically utilised. What a change there is to be seen already—a change which has come upon us almost with the rapidity of lightning. In your country you have but little of this before your own eyes, although even here such facts as the industrial establishments at the Falls of Foyers are too well known to require enlarging upon. But in my country, in Switzerland, there is a perfect fever for utilising water-power in the wildest valleys of the Alps and the Jura, as well as along the broad Rhine; and a similar picture is exhibited in the Tyrol, in the mountainous parts of France, in Spain, in Italy, in Sweden and Norway. Precisely those European countries which have little or no wealth of coalfields are richest in water-power. Both England and Germany are quite as far behind in that respect as they are ahead in the matter of coal, and only the United States are blessed with an abundance of both of these sources of power.

It is a very natural question to ask, whence this sudden race for utilising the power of falling water, characterised in most places, up to recent times, very little by its usefulness, but principally by the devastations caused by mountain torrents, and the beauty of waterfalls? Why are these powers only now becoming confined in the strait-waistcoat of dams, conduits, turbines, and so forth? Why have Switzerland, Norway, Eastern France, and other countries waited for hundreds of years before taking this new departure? Or, to confine the question to a period when the engineering problems connected with the utilisation of water-power have been as well mastered as they are at present, why did that development not take place 30 or 50 years ago, when turbines, &c. were just as well understood as they are now?

The reply in this case is more than usually simple and unambiguous. All those immense quantities of energy would go to waste to-day as they have from time immemorial, had it not been for the rapid development of the transformation of kinetic energy into electricity, and *vice versâ*, and more especially of the transmission of the electric current over great distances by means of high-tension currents. In these times of rapid progress, we are apt to forget facts which are comparatively recent, and it is as well to establish a landmark here and there. I may therefore be excused if I point out such a landmark from my personal experience. About 15 years ago, when the dynamo was already well known, and almost as perfect as it is now, and when Edison, Swan, and others had removed incandescent electric lighting from the rank of a mere curiosity to that of a well-established practical process, I was one of the members of a commission appointed by the governing body of the Zürich Polytechnicum to report on the question of introducing the electric light into the various buildings of our institution. The question at issue was, whether the necessary power could be obtained from the Corporation waterworks, about a mile away from the site of the Polytechnicum buildings, but this was negatived on the strength of the opinion of a most distinguished professor of physics, who stated that the cost of the copper cable for such a distance would be quite prohibitory. At that time no one thought of high-tension currents in such cases. A very few years later, in 1889, the same professor superintended the celebrated great experiment at Frankfort, in which several hundred horse-power was transmitted from Lauffen, in Würtemberg, along thin wires for a distance of more than fifty miles by means of a current of very high tension—an experiment which laid the foundation of the cheap transmission of electricity over long distances. Only since that time has it been possible to generate power at some hardly accessible place right among the mountains, convert it there and then into a high-tension current, conduct this over many miles to some place more adapted for manufacturing operations, and to transform it there into low-tension currents. If we consider that, for instance, the cost-price of motive power in the industrial lowlands of Switzerland is about 11*l.* to 12*l.* per steam horse-power per annum, whilst that of properly regulated water-power in the mountainous districts is not much above 1*l.* per annum, it requires no further argument to indicate the possibilities offered by the electrical transmission of that power to more favourably situated districts. It is true that the cheapness of transmission over a long distance is discounted, not so much by the loss of current in transit, as by the cost of building and maintaining long electric conduits. In Switzerland we reckon at present that at a distance of about 60 miles from the waterworks, the cost of electrically transmitted power is about the same as that of steam-power. But there is a goodly margin up to that limit, and altogether new possibilities have been opened out in Switzerland, Norway, and similarly situated countries for all industries which are based on cheap motive power, and for those requiring cheap electricity.

Still, we must not lose sight of one of the most important factors of the economical side of any commercial enterprise, *viz.*, the cost of carriage of the raw materials to the factory, and that of taking the manufactured products to the market. Another important consideration is the possibility of procuring suitable labour in the neighbourhood. These conditions are in very many cases prohibitory to the erection of factories in localities where cheap water-power is abundant; and even where not mechanical power itself, but electricity as such is the agent required, a great distance from the market must be a bar to the development of the manufacture of heavy articles requiring much carriage. What can be borne in the case of somewhat expensive articles, like chlorate of potash or calcium carbide, may be impracticable under certain conditions for bleaching-powder or soda-ash, and therefore, in the manufacture of these heavy chemicals, coal is not so heavily pressed by water-power as in that of finer chemicals, even where electricity is concerned. The considerable influence of Customs duties on the possibility of exportation and importation must not be lost sight of either; nor, to touch one of the most momentous items, the mental forces possessed by various nations in various degrees, and developed by their different systems of education, and enabling some nations much more than others to readily grasp any new application of natural forces. This brain energy is surely just as valuable as other, more tangible, forms of energy.

I have mentioned that there is a distance limit up to which the transmission of electricity in the shape of high-tension currents may be carried before it becomes too expensive for practical uses. We must not forget, however, in the first instance, that future inventions and discoveries may very considerably extend those limits, and there is no absurdity in assuming that they may be extended to hundreds of miles. Nor must we forget that there are means of doing altogether without the connecting link of copper wires, just as we are already able to transmit electric force in the somewhat clumsy form of storage batteries, aptly called accumulators. At present the commonly used portable "accumulator" of force is coal; but this gift of nature is very imperfect as to the degree to which its energy can be transformed into other forms of energy, and at all events it is not in our power to create it at will. Another such portable "accumulator" of force we have quite recently found in calcium carbide; and it is characteristic that the majority of newly erected electric plants in Switzerland, Austria, and France aim at the manufacture of this article, although its only use at present is the generation of acetylene for illuminating purposes. What is more likely than that, with calcium carbide produced by very cheap water-power and otherwise improved methods of manufacture, acetylene may serve as a basis for a multitude of other uses, caloric and chemical? And who will say that there will not be some other product discovered which will enable us to store up energy in even cheaper form and transmit it over long distances by means of electrically driven machinery? The range over which the energy of the Alpine watercourses could be turned to practical uses would then be again enlarged.

I cannot pretend to exhaust all the existing possibilities for water-power; and I will only for one moment touch upon the transformation of this power, with or without the intermediary of electricity, into heat, and of its thereby replacing coal even in that field.

We shall better appreciate the questions at issue by dealing with actual figures. Prof. Borchers, at this year's meeting of the German Electrochemical Society, gave a number of carefully compiled estimates, of which I will take those most interesting to us in the above respect. The following amount of electrical power for chemical and metallurgical purposes has been hitherto made available, and the machinery for it is either already erected or definitely undertaken:—

—	Water H.P.	Steam H.P.	Value of Products to be manufactured.
			£
Austria	27,000	23	550,000
Belgium	..	1,000	30,600
France	110,140	1,300	2,250,000
Germany	13,800	16,173	2,750,000
Great Britain	11,500	8,150	450,000
Italy	29,485	..	480,000
Norway	31,500	..	370,000
Russia	6,075	1,500	225,000
Spain	7,100	..	140,000
Sweden	29,000	..	440,000
Switzerland	38,950	..	630,000
United States	72,300	11,750	19,500,000
Canada	1,500	..	22,500
Transvaal	..	454	1,440,000

In the case of the United States, the amount of water-power utilised for electrical purposes will no doubt largely exceed the above within the near future. Their natural gas, certainly a far more transient gift of nature than coal, also comes into play with the figure of 2,500 h.p. used for electrolytic factories. The total of the water-power enumerated in the above table reaches 378,000 h.p., against only 40,350 steam h.p., and part of the latter is not produced by ordinary coal, but by very low-grade lignite or peat not otherwise usable for industrial purposes as it occurs in some parts of Germany. The long-debated question of utilising the peat of Ireland might be approached in the same way, and what has been already done with great success at Bitterfeld, in Prussian Saxony, might be equally successful in the Bog of Allan.

The enormous value of the products to be produced in America by the aid of electricity belongs mostly to the province of metallurgy, copper, silver, gold, and aluminium. Leaving these aside, I will now quote a few of the figures referring to the products of the chemical industries in the more restricted sense, *viz.*, those estimated by Borchers as producible when all the electrical plants now building or projected have been carried out.

——	Chlorate of Potash.	Caustic Potash.	Caustic Soda.	Bleaching Powder.	Calcium Carbide.	Carborundum.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Austria	..	..	7,200	15,750	21,000	..
Belgium	..	..	1,600	3,500	..	..
France	6,300	..	45,280	99,050	35,000	800
Germany	120	17,280	2,600	51,200	12,444	225
Great Britain	..	..	11,200	24,500	8,100	..
Italy	..	..	..	..	29,450	..
Norway	..	..	..	..	24,500	..
Russia	..	..	2,400	5,250	6,000	..
Spain	..	..	3,860	7,350	5,000	..
Sweden	2,000	..	..	..	25,000	..
Switzerland	1,850	..	3,300	7,200	28,250	..
United States	330	..	5,120	11,200	60,000	800
Total	10,600	17,280	82,560	225,000	254,744	1,825

Sundries, as sodium, white lead, &c., are not enumerated here, nor can I vouch for the correctness of Prof. Borchers' estimates even for the present and the immediate future. I have not the slightest doubt that some of my hearers would be able to pick holes in them here and there. I myself have great doubts whether, for instance, the high figures appearing under the heading of France will be realised just now. But I think that the general results cannot be very far from the truth, and according to these the electrical plants now at work or projected would produce altogether upwards of 80,000 tons of 70 per cent. caustic soda, 17,000 tons of 80 per cent. caustic potash, 11,350 tons of chlorate of potash, and 225,000 tons of bleaching powder. Of this total by far the greatest part would be made by water-power, a somewhat considerable part by the cheap lignite of Central Germany, and only a comparatively small part by coal.

Last, but surely not least, we must think of this, that fossil fuel is hoarded-up wealth, to which nothing can be added, and which a little sooner or later will have ceased to exist; but water-power is a gift of topographical configuration, lasting practically for ever, and ceaselessly flowing through all centuries. The comparative advantages of those countries which possess the latter kind of wealth will consequently increase with the lapse of time.

Taking a broad view of the question of fuel and of power, and of the industrial development of mankind intimately connected with them, we can distinguish three great periods. The first of these extends from the dawn of history to little more than a hundred years ago. Almost the only fuel employed during that time was wood; the uses of coal or of peat were too insignificant to influence the general course of events. The sources of power were confined to that of men, of animals, of water, and of wind, the latter mainly for the propelling of ships. Whilst at several epochs during the former history of mankind some nations rose to the greatest eminence in the fine arts and in poetry, and whilst decorative art also, which in the higher forms will ever remain the province of individual task and hand work, celebrated triumphs which we must now regard with envy, the progress on the technical side was extremely slow, and in many cases even a temporary retrogression took place. Road engineering and stone work were very well understood, but even here the aid of iron was necessarily restricted to a minimum, and machinery proper was only known in its most elementary forms. The same holds good of all the industries connected with chemistry. To give just one illustration of this, the bronze lamps found at Pompeii, which as works of art serve our own artists as classical models, in a technical respect do not soar above the Eskimo lamps, and no better construction was known till nearly the end of the last century. In this, as well as in a thousand other instances, we date a new epoch from the time when two great events took place—the rousing of people's minds by the French Revolution, and the birth of modern chemistry, metallurgy, and mechanical engineering. We are here unconcerned with the former, but all the more with the latter event, and a very short glance will teach us that all those great inventions would not have been made, or, if made, would have been practically useless, and would have sunk into oblivion again, but for the fact that since that time one nation after another has awakened to the perception of the value of fossil fuel as a source of power. Nothing was more natural than that this country, which possesses the richest and most accessible coalfields in Europe, should take the lead in the sudden start of industrial development, which has been going on in geometrical progression for the last 50 years, and for which coal forms an indispensable basis. Of course, other circumstances had their effect in establishing the industrial supremacy then acquired by Great Britain, for we must not overlook the fact that the mere presence of coal would not have done this. China and the North American Continent abound in coal far more than England, but neither the Chinese nor the Red Indians have turned it to account; nor had the Britons themselves done so for thousands of years, and British industry during all that time was not in the race with that of France, Germany, the Netherlands, or Italy. But when, by a lucky coincidence, the exhaustion of timber in Great Britain had compulsorily drawn attention to coal, just before the time when great men of science and great inventors arose, both in this country and in others (especially, at first, in France) —men who taught their fellows how to make use of that natural wealth—the time was come for the second of the great periods of which I am speaking, that period which in one century has advanced the mechanical and chemical industries a hundred times more than all the centuries preceding it. It was quite natural that Great Britain should take the lead in that development; this country possessed both the raw material and at the same time also the inventive genius to a greater extent than any other nation, and it was, moreover, immensely favoured by its insular position, which kept it out of the direct effects of the 25 years of war following upon the French Revolution, which, on the Continent, made all industrial progress extremely difficult, and to a great extent quite impossible. The start thus gained by Great Britain assisted her industry for a long time afterwards, and has even now not quite lost its power, through the accumulation of capital and of experience joined to the natural advantages possessed by this country. But this will not last for ever, as is best witnessed by the ever growing competition of rivals, who were hardly in the field at all a generation ago, who, equally with Great Britain, possess coal, intelligence, and energy, and who to-day claim their place in the forefront of manufacturing progress.

Looking beyond the horizon of a single nation, we cannot possibly disconnect the marvellous progress of industry during this short second period from *coal*, without which it would seem to have been utterly impossible. But let us realise what that means! For millions of years the earth has been rolling in its orbit and building up its crust, and all that has remained from that endless time in the shape of potential energy is a certain comparatively restricted stock of coal. Six or seven thousand years ago man emerged from the state of savagery and gradually built up our present state of civilisation, without to a perceptible extent employing coal as fuel, and not employing it at all as a source of motive power. Little more than a hundred years ago that stock of petrified energy, the accumulation of all preceding ages, was broached, and is now being used up at such a progressive rate that the second period in the history of industry which is based on the use of coal cannot last more than a few hundred years, and can thus form only quite an insignificant episode, leading up to the third period when man will rely no more on those accidental scant remnants of former epochs, but will carry on his work with the direct help of the solar energy incessantly pouring down upon the earth in the shape of heat, light, and other forms of radiation, partly transformed here into water-power. This second period, that of the coal age, as we may call it, has been of incalculable value for the progress of mankind, for it is more than doubtful whether man would ever have found the means of turning the material stores and the living powers of nature to his account without that extremely convenient accumulator presented to him in the shape of coal. But, for all that, the part played by coal in the history of mankind is necessarily a transient one, and equally transient must be the advantages enjoyed by those countries which happen to be favoured by a wealth of fossil fuel. On the other hand, those countries will have the advantage in the race of industry which are more favourably situated for the perennial manifestation of terrestrial and solar energy. There are several forms in which it may be possible to utilise this lasting source of energy, but for the present we need not regard any other than that of water-power, nor any other way of handling this power than its transformation into electricity, which can be used directly as such, or retransformed into motive power or into heat.

The summary of the above, as applied to our own field of chemical industry, is this: that the manufacture of those chemicals which are exclusively made by the help of electricity, such as calcium carbide, for instance, and of those which are more cheaply produced by that agent than by other methods, will in the future be principally carried on in countries possessing great water-power, and will no doubt be divided amongst them in a proportion regulated by the cost of carriage of both raw materials and products from or to the nearest important market. The manufacture of chlorates, for instance, can be carried on at places more remote from the consumers than that of bleaching powder, and in this case electricity will probably be paramount within a short time. According to the statistics given by Prof. Borchers, the electrical plants already in existence or devised are capable of supplying 225,000 tons of bleaching powder, which is probably equal to the present consumption of the whole world; but it would be rash to conclude that the Weldon and Deacon processes are doomed to speedy extinction, whatever their more remote future may be. Probably the establishment of a good number of the electrolytic plants devised on paper in out-of-the-way places will be retarded, precisely because the bleaching powder to be made there cannot as yet compete with Weldon and Deacon bleach made nearer to the market.

It stands to reason that those countries whose industrial mainstay up to the present is their wealth of coal will not stand by quietly and see themselves deposed by other countries more favoured in the matter of water-power, without making determined efforts to hold their ground; and this will be all the more necessary when, as is inevitable in the future, the price of coal will rise in consequence of its constantly increasing consumption and the corresponding decrease of the quantity available for mining. But, without even looking at that, after all, somewhat distant prospect, the present situation of the heavy chemical industries is quite sufficiently serious to call for the only remedy which can stave off the evil day, that is, for the greatest possible economy in the use of coal. All observant travellers in the timbered parts of the United States have bewailed the reckless dealing with the forests prevalent there, the baneful consequences of which are already felt in many places. But worse than this has been the reckless waste of coal which has been going on from the time this fuel first came into use until very recently; for, after all, timber grows again, although slowly, but coal does not. Even now vast quantities of coal are burned in a most uneconomical way, as Mr. Beilby has pointed out at length in his presidential address. I will only give a few instances of this. Small donkey engines and other non-condensing engines consume up to 5 or 6 lb. of coal per horse-power per hour, whilst the best ocean steamers require only $1\frac{1}{4}$ lb., and less than 1 lb. of coke or anthracite is consumed by the best Dowson gas-engines. I am perfectly aware that the economy attainable by generating motive-power with the best kinds of boilers and engines in central stations would, in many cases, be more than counterbalanced by the cost of subdividing that power and transmitting it to the places where it is wanted; but surely a great deal more progress could still be made in this direction. Then let us look at the greatest coal-eater in this country—the blast-furnace. True, the state of affairs has changed very much since the time when I first came to this country, in 1864, when I saw all over Staffordshire, Tyneside, and Lanarkshire huge flames belching out of the furnace mouths, and when the provision of a furnace with gas-saving gear was quite exceptional. Probably not one open-mouth furnace now exists in the United Kingdom; the waste gases are everywhere used for heating the blast, for raising steam, and so forth. But for all that there is still an enormous waste going on; and it is only recently that serious efforts are being made to construct and work gas-engines utilising the whole of the blast-furnace gases, and thus to squeeze out several thousand horse-power per furnace, in addition to the work previously done by means of the gases.

The last instance I will mention is the manufacture of coke. In this country, according to Mr. Beilby's presidential address, about nine-tenths of all the coke produced is made in the old-fashioned beehive ovens, thus wasting from 10 to 15 per cent. of the coke, and all the tar and ammonia. Here again I need not be reminded of the reasons which explain the slow rate of the introduction of modern coke-ovens, and some of these reasons I must acknowledge as valid to a certain extent, especially the great cost of the plant. But why have the German coke-makers, who assuredly do not command more capital than their English colleagues, been so much quicker to introduce the new methods? Some of these reasons must be put aside altogether as erroneous, especially the alleged low value of the coke made in other than beehive ovens, as being refuted by very many years' experience in all iron-making countries.

One of the most prominent efforts in the direction of a better utilisation of coal is the Mond gas-producer, born and developed in your own neighbourhood. But this apparatus is not calculated to develop more heating power out of the coal than its direct consumption or its conversion into other gaseous fuel; its aim is the recovery of part of the nitrogen of the coal in the shape of ammonia. This object, I believe, the Mond producer really does attain, but in this respect it is in direct competition with the apparatus devised for utilising the ready-formed ammonia from coke-oven gases, which, if applied to all coke-ovens, would alone supply the world with more than twice the ammonia it seems to need at present. The very considerable cost of the plant, together with the very natural fear of seeing ammonia go down to an unprofitable level of prices by an over-supply, has retarded the extension of the use of the Mond gas-producer, and at all events we cannot see in it anything like the solution of the great coal question.

I may be allowed a few words on another process, probably much less known to you than those I have just mentioned, as it was invented only a short time ago, and has been developed into practical shape only during the last year or two. I refer to the Dellwik water-gas process, briefly mentioned in Mr. Beilby's address, and now justly called the Dellwik-Fleischer process, since its original form has been greatly improved by Dr. Fleischer. Many of you will remember the claims made for water-gas a good many years ago as the "fuel of the future." I felt bound at that time to oppose the exaggerations spread abroad as to the scope of water-gas, and to do my share towards reducing its claims to their true level, as it then stood, *viz.*, that of a basis for illuminating gas under certain conditions, and further, as a special fuel for the production of the highest temperatures practically possible before the introduction of electrical heating. I denied that water-gas could be considered as a general fuel, because, in order to produce it, more than half the caloric value of the fuel had to be lost, partly by radiation, &c., and partly in the shape of a producer-gas, necessarily made in that process as it then stood. Now, since the Dellwik-Fleischer process has changed all this, I feel bound to proclaim this fact, and to give an explanation of the divergence between this and all previously known water-gas processes. Recollect that the formation of water-gas is an endothermic reaction: $C + H_2O = CO + H_2$, requiring an extraneous supply of about 29,000 calories in the case of steam or 40,000 calories (centigrade-gramme) in the case of liquid water per grm. molecule. This quantity of heat is in practice always supplied by bringing a large stock of fuel to a bright red heat by means of an air-blast; water-gas then is made by blowing in steam, but only till such time as the heat has not sunk below the proper temperature for the reaction, that is, about 1,000° C. The first or "blowing-up" phase in the water-gas manufacture, as hitherto carried on, generally lasts 10 minutes, the second or "gas-making" phase only five minutes, and during the first phase the gases formed by the blowing-in of air are found to contain, apart from nitrogen, hardly any carbon dioxide, but only carbon monoxide. This is due to the fact, established both by laboratory experiments and by working on the large scale, that at temperatures above 1,000° C., *under ordinary circumstances* carbon is burned not to CO_2, but to CO; moreover, if any CO_2 were formed near the tuyères, it would be reduced to CO by the great depth of red-hot carbon it meets before issuing from the producer. Indeed we need only remember that these facts are the basis of action of all the thousands of gas-producers of various forms, worked for ordinary "producer-gas" or "Siemens-gas"; and that these producers frequently work with only 3 ft. of fuel, whilst the water-gas cupolas never have less than 4 ft. and usually more, in fact, up to as much as 10 ft. depth of fuel, in order to accumulate a sufficient stock of heat for the gas-making phase. The consequence of all this is, that quite as much carbon is consumed during the blowing-up phase as during the gas-making phase, but only the carbon consumed during the second phase, amounting to about 45 per cent. of the heat-value of the fuel, is utilised as water-gas, and that which escapes during the blowing-up as carbon monoxide, is mostly wasted, as there is rarely an opportunity for dealing with this low-grade gas at the place where it is generated, and its utilisation at a distant place is prevented by its great bulk, as well as by its intermittent generation and its uneven quality, which renders it much less valuable than ordinary Siemens-gas representing the same number of heat-units and generated just where it is wanted. We need not seek for further reasons why the great expectations entertained about 10 or 15 years ago of the future of water-gas as a fuel have not been fulfilled.

About two years ago it became known that by a new process, invented by a Swede, Mr. Carl Dellwik (Eng. Pat. 11,632, May 1896, this Journal, 1897, 525; and Eng. Pat. 29,863, Dec. 1896, this Journal, 1897, 431), the blowing-up phase was so changed that CO_2 was formed instead of CO, and that thereby the production of water-gas from a given quantity of fuel was to be more than doubled. At first, I suppose, very few people believed this to be true, but these doubts were removed by the reports made by such experts as Prof. Vivian B. Lewes, Prof. Bunte, and Dr. Leybold from their observations at Warstein, in Westphalia, where the process has been developed into a thoroughly practical shape by the labours of Dr. Emil Fleischer and others. But how could the results obtained at Warstein (and it may be added, at a score of other works since) be explained in the face of the previously mentioned fact that the high temperature and the great bulk of the fuel must needs lead to the production of CO, not to that of CO_2, during the blowing-up stage?

I deemed this matter of such theoretical interest and of such practical importance that I resolved to examine it for myself by a visit to Warstein, which visit I made on June 1st of this year. Every facility was given me for my examination, and I fully confirmed the facts found by my predecessors. We worked for eight hours in succession, and during this time 26 "runs" were made, each consisting of "blowing-up" and "gas-making." The times occupied by these two phases were found to be more than reversed in comparison with the former practice, *viz.*, $1\frac{3}{4}$ minutes for the blowing-up, as against 10 minutes, and 8 to 10 minutes for the gas-making, as against 5 minutes. The water-gas produced was of perfectly normal quality, as ascertained by the subsequent analysis of a carefully taken average sample, *viz.*:—

	Per Cent.
CO	39·65
H	50·80
CH_4	0·82
C_nH_{2n}	0·05
CO_2	4·65
O	0·20
N	3·83
	100·00

The blowing-up gas was tested on the spot during nearly every one of the runs; it did not contain appreciable quantities of CO, but from 17 to 19 per cent. of CO_2, usually about 18 per cent., with 1 or 2 per cent. of oxygen. The quantity of coke consumed was weighed all along, care being taken to leave as much in the producer as had been found before commencing work. We burned 245 kilos. of coke, and produced 632 cubic metres of water-gas (reduced to 0° C. and 760 mm. pressure). This means 2·58 cubic metres per kilo., or almost exactly the same as found by Vivian B. Lewes, *viz.*, 2·56 cb. metres, or 1,000 cb. ft. to 24·5 lbs. of coke. This is about twice as much as is obtainable by the best of the old processes, and it means that instead of utilising 45 per cent. of the fuel value, Dellwik utilises 82 per cent. and loses only about 18 per cent. by radiation from the producer, by the high temperature of the gases and by minor sources. Lewes himself, in his report to the Incorporated Gas Institute, said this would sound to many like a "fairy tale"; but it is nevertheless a hard fact of which he convinced himself, and which I, among others, have confirmed.

How can this fact be reconciled with the equally certain fact that up to the present all other forms of apparatus have only produced CO during the blowing-up, and have made but 1 cubic metre of gas from 1 kilo. of coke? Both these things run entirely parallel; since, when burning C to CO_2, more than three times as much heat is produced and accumulated in the mass of the fuel as when converting C into CO, the time occupied by the respective stages of blowing-up and gas-making must be necessarily changed to the advantage of the former process, and the quantity of water-gas made must be increased correspondingly. The explanation of this enormous difference is not due to the fact, as some may imagine, that the Dellwik gas-producer differs materially in construction from those previously known, but that it is worked at a higher pressure of blast than was formerly employed, adapted exactly to the height of the column of fuel, so as to produce a much greater speed of the current of air. Thus, in the same space of time, each unit of carbon comes into contact with much more oxygen than usual; the conditions of chemical equilibrium for that temperature are changed, and the point where C combines with only one O is moved upwards, so that even at 1000° to 1200° C. CO_2 is formed. Nor is this CO_2 reduced to CO by the red-hot carbon present in excess, precisely for the same reason, *viz.*, because the excess of oxygen enveloping it presents other conditions than those present in all former cases, the action of mass coming into play.

Through the Dellwik process we are now in possession of a method for obtaining at very low cost a concentrated gaseous fuel of from three to four times the caloric power of Siemens-gas, capable of being conducted over great distances in pipes of moderate dimensions, and although of much less caloric power than ordinary coal-gas, possessing several advantages over this of the greatest importance; in the first place that of incomparably less cost. But to this we must add that water-gas burns with a smokeless flame, and what is a most remarkable and not yet thoroughly explained phenomenon, its flame is very much smaller than that of coal-gas, even when burned in a Bunsen burner, and consequently is of a very much higher temperature, *viz.*, a good deal above the melting point of platinum. Many years ago when the Essen water-gas process aroused much attention in continental circles (it is practically the same process as was afterwards introduced into England by V. von

Langer), I contemplated applying it to problems of high-temperature chemistry not approachable by any other then known means, for instance, the decomposition of NaCl by steam, but I was deterred from pursuing these principally by the waste of fuel inseparable at that time from the production of water-gas. But this bar is now removed, and we are now in possession of a new source of very high temperatures, not as potent as the electric arc, but costing only a fraction of this, *viz.*, no more than the comparatively moderate temperatures formerly attainable by means of ordinary gaseous fuel. It cannot be doubted that this new power will be utilised in many ways we hardly dream of at present, probably by chemical inventors more than any others.

Let us now glance rapidly at the various industries usually understood to belong to that domain of "alkali industries" with which the principal life-work of Hurter, as well as the best part of my own, is associated. I shall not be able to illuminate my theme with the light of Hurter's genius and of his intimate connection with the greatest alkali-making firm in the world, but I am at least free from business restrictions, and I can speak freely of what I know.

We naturally begin with *sulphuric acid*, and here we are at once confronted with the greatest revolution which has taken place since that acid became a commercial product in the days of Ward and Roebuck; a revolution beside which the invention of the Gay-Lussac and Glover-tower, let alone that of plate-columns and the like, sinks into insignificance. I mean, of course, the total abolition of the vitriol chamber, and even of the use of nitrous fumes as oxygen carriers, by the use of the catalytic power of platinum, perhaps also by that of ferric oxide and other substances, a reaction of which the first literary landmark is the British patent of Phillips taken out in 1831, but which has been mainly worked out by German chemists, Döbereiner, Magnus, Wöhler, Plattner, Clemens Winkler, and others, not to forget my originally German countryman, Messel. All of these had been content to apply that reaction to the preparation of sulphur trioxide, in the shape of Nordhausen fuming acid. Some years ago it was whispered that the Badische Anilin and Soda Fabrik had perfected and cheapened that process to such a degree that they were manufacturing ordinary sulphuric acid in this way cheaper than by the old process, and that they were gradually pulling down their vitriol chambers. This was hardly believed to be possible, and was taken as an exaggeration of the truth. But last year the Badische applied for patents in all countries, some of which are now published. Other firms have proceeded on the same lines partly with other contact substances, among them oxide of iron in the shape of pyrites cinders, with which I myself experimented many years ago as a means for combining SO_2 with oxygen.

We now know the Badische invention. The principal feature of it is their discovery that it is necessary to get rid of the heat of the reaction in order to obtain a quantitative union of sulphur dioxide and oxygen to sulphur trioxide, and that under such circumstances a *complete* union is obtained, even when using ordinary dilute technical gases, such as result from pyrites burners. As a measure of the progress made, I may remind you that—as I wrote at the end of the year 1897 in "The Mineral Industry of the United States and other countries," p. 130:—

"Probably 67 per cent. must be considered very good work, and the remaining 33 per cent. of sulphurous acid must be sent into lead chambers, together with better gas from other burners."

In lieu of 67 per cent. we must *now* speak of 98 per cent.

The said removal of the heat of reaction can be effected in such a way as to heat the entering gases to the temperature necessary for the reaction, so that the contact stoves when once started work automatically.

A further important feature of the Badische invention consists in the discovery of the reason why the contact-substance (platinised asbestos) as hitherto used, in a short time wholly or partly loses its activity, and of means for preventing this. The cause of this loss of activity has been traced to certain constituents in the technical gases, the deleterious action of which was hitherto unknown. To remove these, a special washing process has been invented, which in a certain direction goes far beyond any attempt at purification published up to this time.

Of course there is still a wide step from knowing those principles, to carrying them out as paying concerns; although former employees have offered their knowledge of the principles referred to for sale for several years, it is not known that anyone has successfully manufactured from their information. But it is absolutely certain that at Ludwigshafen itself that step has been made, and that in more than one large works the lead chambers are either entirely abolished or are at least moribund.

This is a sad outlook for those whose capital is to a great extent sunk in the old vitriol process! But as yet very many of them need not despair. It would appear that in the case of less concentrated acids, up to the point of chamber acid, or even Glover tower acid, the chamber process can still compete with the catalytic process, and for acid of such strength there would be no need whatever to incur the expense of introducing the catalytic system. Indeed, the Badische patents state:—

"Acids weaker than up to 50° Bé. (that is, containing about 63 per cent. H_2SO_4) can, according to this invention, be prepared at least as cheaply as by means of the chamber process, and all stronger acids are produced by this invention more cheaply, the advantages being greater the stronger the acid."

In cases, however, where the purity of the acid is an important point, the Badische process is advantageous even for dilute acids, for all the acids made by this process are exceptionally pure and especially free from arsenic. It is worth mentioning also that the cost of plant for the new process is considerably less than that of the old one and requires less space. Thus, in the Badische works, I am told, that the capital outlay for a plant which is used for making all grades of acid from anhydride down to weak acid costs about two-thirds as much as a plant calculated to yield a corresponding quantity of concentrated oil of vitriol of 66° Bé.

Since in the case of less concentrated acids, say up to about 80 per cent. H_2SO_4, the chamber process can still compete for cheapness with the catalytic process, the enormous capital sunk in vitriol chambers for the manufacture of super-phosphates, of salt-cake and all analogous cases would still remain operative; but certainly vitriol makers are now put upon their mettle to look out for the best means of improving the efficiency of their plant and of their method of working. For various reasons I shall abstain from going into details on that point; but I may be excused for indulging in some "music of the future," in mentioning the advantages to be derived from using oxygen in a more concentrated form than that of atmospheric air. The proposal of Messel for employing electrolytic oxygen, or that of myself for Brin's oxygen, came undoubtedly too early even for the manufacture of SO_3 at its former prices, but since we can make a gaseous mixture rich in oxygen very cheaply by liquefying air, the possibility of employing that mixture in the manufacture of sulphuric acid is decidedly less removed from the sphere of actuality. In Germany "Linde-Luft," as it is there called, is already an article of commerce; it is actually used for the preparation of an explosive, and it is at least thought of even for such uses as the working of gas-producers. In America they are going ahead with it much faster, if we may credit even a portion of the sensational accounts which reach us. Do not let us forget that in this case the advantage will again lie with those nations who possess cheap force in the shape of water-power, in order to produce liquid air.

Coming back from the aërial regions to the solid ground of present facts, there seems to be no doubt that the catalytic processes have a decided advantage over the chamber process where acid of a higher concentration than Glover acid or of special purity is required.

Proof of this is the fact that one after the other the great German colour works, where mainly strong acid is used, have introduced the new processes, or are making preparations for doing so. But even here some comfort remains to the owners of lead chambers, and glass or platinum retorts and the like. Where the initial cost of plant has been written off to a great extent during former better years, and especially in small-sized works, they will, in the face of the cost of new plant and of the royalties to be paid for the processes, be able to hold on to their existing plant for a number of years. The first to change will be probably those works where much waste acid is to be disposed of and reconcentrated, as for instance in the manufacture of explosives. But I must content myself with these general allusions.

Let us pass to the second of the great industries belonging to our field, to the manufacture of *salt-cake and hydrochloric acid*. A technologist cannot but be sorry that the splendid Hargreaves process appeared on the scene just too late to reap the fruit of the genius and of the perseverance of its inventors. If it had reached its perfection 10 or 20 years sooner, it would, in my opinion, have spread ten times more than it actually has done. But, just when it had been thoroughly worked out, the progress of the manufacture of salt-cake was checked by the development of the ammonia-soda process, and very naturally but few manufacturers had the courage to embark on the purchase of such expensive new plant, most of them preferring to work their old plant, with such minor improvements as could be effected without entirely abandoning the vitriol chambers and salt-cake furnaces.

More dangerous to the latter has been the development of the ammonia-soda process on the one hand, and that of the electrolytic processes on the other. On the Continent this battle has been practically decided some time ago. The quantity of salt-cake converted into soda-ash or caustic soda furnishes but a small fraction of the alkali made in France and Germany; most of the salt-cake made there goes to glassworks, and can be sold at low prices because the use of hydrochloric acid as such is somewhat extended in those countries—so much so that the question has been already argued whether it would not pay to produce this acid from electrolytic chlorine, of which Germany already makes much more than she can use without exportation, while, as we see from Prof. Borchers' figures, France is preparing to swamp the chlorate and bleaching powder market with electrolytic products. This, together with America, Sweden, Spain, and other countries now going in for cheap electrolysis, will make it very hard for the Leblanc process to survive, seeing that, in its struggle with the ammonia-soda process, it has been relying entirely on its decided superiority in the matter of chlorine products. How long it may still hold out against the foes besieging it from all sides, it is impossible to say: the momentum of the large capital invested in it, and the equally large fresh capital required for establishing new factories will undoubtedly prolong its tenure of life. I remember the late Walter Weldon, speaking to me at my house in Zürich in reply to a question concerning some proposed improvements in his celebrated chlorine process, and saying something like this: "Both the old Weldon chlorine process and the Leblanc process have had their day, and all the capital and the brains spent upon them will not hold up the flow of the tide against them. The future is for the ammonia-soda process of alkali manufacture, and for the Weldon-Pechiney process applied to magnesium chloride from Stassfurt for chlorine." We know that he was right in the former and wrong in the latter of his prognostications, but that as to chlorine a much stronger rival to both his own and the Deacon process has arisen in the electrolytic processes. It would be superfluous to speak to you on this point. Of course here it will also hold good that a certain time must elapse before the fates have accomplished their work. But as far as we can look ahead, at least in my opinion, the next generation will derive its chlorine from electrolysis, and, as the alkali generated at the same time would supply only about one-eighth or one-tenth of the world's wants of the latter article, the great bulk of it will have to come from other sources. Among these, at present the ammonia process stands foremost, and we see no reason why it should recede from this place; but a certain portion of alkali will be supplied by natural soda from Egypt and from the West of the United States, very possibly also by a better system of working up nitrate of soda for nitric acid, and from minor sources.

I have come to the end of my address, and this takes me back to its beginning. We cannot but remember how Hurter strove to elucidate theoretically and to improve practically nearly every one of the processes which we are compelled to declare as doomed, if not to complete extinction, at least to a most serious crippling. He is only one, although one of the foremost, workers in this field, which so many men of the highest note in England, France, and Germany have tilled, besides innumerable more modest workers, among whom I have also taken a humble share. Those of us who are still in the land of the living, cannot help being sorry that, apart from the material losses involved in that great revolution in the alkali industries, so much earnest effort of genius, of inventive talent, and of honest labour, has been apparently wasted on a transient aim. But every private individual must resign himself to the fate that his life's work is only as the preparation of the soil, in which others will sow their seed and reap their harvest, only to share a little later the same fate as that to which we have had to submit ourselves. Enough for the day is not only the evil, but also the good thereof. Happy those to whom, as to Hurter, can be applied Schiller's words:—

> "Denn wer den Besten seiner Zeit genug gethan,
> "Der hat gelebt für alle Zeiten."

Mr. Geo. Beilby, in moving a vote of thanks, said he considered it a great privilege to take part in this interesting meeting. He had followed with interest and sympathy the movement, which originated more than a year ago in the Section, for the perpetuation of the memory of the late Dr. Ferdinand Hurter; and he must say that the prompt action of the Committee had excited in his mind great admiration. As a Section they were to be congratulated on the way this work had been carried out. He thought the Committee had made an admirable selection in fixing upon Dr. Lunge to deliver the first lecture. They knew that he had been intimately associated with the same industries and the same interests as Dr. Hurter; they knew that they had been personal friends, and it was certain that in calling upon Prof. Lunge to open the Hurter Memorial Lectures they were calling upon absolutely the right man. Those who had had the privilege of listening to Dr. Lunge's lecture must have felt that their anticipations had been fully justified. He was extremely gratified that the few words of reference in his Newcastle address to the Dellwik process had so quickly been followed up by Prof. Lunge, who had actually witnessed the process in operation and put it to a practical test.

Mr. E. K. Muspratt, in seconding the vote said, that when the local committee had got together the necessary funds, their next wish was to find the most suitable man to give the inaugural lecture, and they all welcomed Dr. Lunge's acceptance of their invitation. When the Society of Chemical Industry was founded some 18 years ago, they did not know that it would grow into a society embracing all the chemical industries of the country. Referring to Dr. Hurter, whenever the Liverpool Committee had been at a loss for a paper they had always been able to appeal to him, who at any time would give them an interesting lecture upon some question of technical chemistry which was at the moment engaging his attention. Although, as Prof. Lunge had said, Dr. Hurter might possibly have been under certain restrictions because he was engaged with a firm of chemical manufacturers—and it was not likely that chemical manufacturers would tell all their secrets—yet, notwithstanding these restrictions, no one who heard his papers ever found them devoid of interest. There was one remark that Prof. Lunge made which they ought to take to heart, namely, that as the energy stored up in coal diminished in quantity in this country, we must find a substitute in the development of brain energy. It was brain energy that they now had to develop. It had been developed by the superior education given in other countries, but he hoped, now that they had founded an institution like University College in Liverpool, as well as other similar colleges in other towns, that they would not suffer as they had done in the past from a deficiency of the higher education.

Prof. Campbell Brown, in supporting the vote, said that they had in the life-work of Prof. Lunge, as well as in that of the late Dr. Hurter, whose memory they had come there to honour and commemorate, striking illustrations of that close association between pure science and its technical applications which was equally essential to the progress of both. Dr. Lunge had spent many years of his life in the pursuit of manufacturing chemistry, and he was now professor in the great Swiss university, which boasted one of the finest—if not the finest—chemical laboratories in Europe. For the masterly and stirring address which Prof. Lunge had given them that night, they thanked him.

Prof. Lunge said it had been one of the greatest honours of his life that he had been called upon to deliver the first of the Hurter Memorial Lectures, and they had increased the value of that honour by the cordial reception which they had given him. Let them ever honour the memory of such men as Hurter, who in his life-work was not content with merely doing what was imposed upon him in the ordinary course of duty, but strove to do his best for the advancement of science and of technology.

Obituary.

HAMILTON YOUNG CASTNER.

Member of the Society of Chemical Industry.

The death of Mr. Castner on the 11th October has deprived the world, not only of a thorough chemist, but also of a business man of very marked ability, and one whose name is likely to live among those men of science who have devoted their energy to practical manufacturing processes.

H. Y. Castner was born at Brooklyn, N.Y., in 1859. He had as a boy a natural taste for carrying out both chemical and electrical experiments, and this taste, together with a natural quickness of perception of the salient points of an experiment or process, stood him in good stead when, after leaving the private school in Brooklyn at which he had been educated, he entered Columbia College and took up the study of Chemistry under Prof. Chandler.

After leaving college he established himself as an Analytical Chemist in New York, and fairly rapidly secured a standing and position, which led to his being called in as a scientific expert, not only by private individuals, but also, in at least one case, where a chemical question under the United States Tariff was before the courts. When unoccupied with his analytical work he was constantly experimenting with a view to improve chemical manufacturing processes, and among his first successes was one for the manufacture of bone black. Subsequently he was in doubt whether to investigate the possibility of commercially producing artificial diamonds or of reducing the cost of production of sodium, at that time exclusively used for the manufacture of the then expensive metal aluminium. He eventually chose the latter, and, oddly enough, while carrying out his experiments, accidentally produced quite a number of minute artificial diamonds. His experiments resulted in a satisfactory commercial process being arrived at, and we believe his patent was the first ever granted in the States for a process for manufacturing the alkali metals.

Castner came to London in 1886, and established a small experimental works near Waterloo Bridge, where he demonstrated the practicability and economy of his process (a description of which will be found in this Journal, 1886, 601); and eventually works on a manufacturing scale were started by the Aluminium Co., Ltd., at Oldbury, where both sodium and aluminium were produced and placed on the market at prices previously unknown.

The latter history of H. Y. Castner is so well known, both here and abroad, as to require but little comment. The introduction of the electrical process for making aluminium rendered the purely chemical process obsolete; but Castner was again to the front with the first practically successful process of electrolytically producing sodium direct from caustic soda, and this was followed by a process for producing peroxide of sodium to be used as a bleaching agent, as well as by other processes of chemical interest. Equal with, if not more important than his sodium process was his process for the production of caustic soda of high purity, and of bleaching powder by the electrolysis of chloride of sodium. The idea of electrolysing salt solutions was of course old, but, until the works of the Castner-Kellner Alkali Co. were completed and the product placed on the market, comparatively little had been commercially done in this line.

Mr. Castner's health had not enabled him to winter in England for some years past, and by medical advice he was proposing to winter on the borders of Lake Saranac, in the Adirondack Mountains. But consumption—that dread disease of so many—claimed him just a month after his fortieth birthday, and so has passed away a man, young in years, but one who has left the impress of his knowledge and ability on the chemical manufacturing industries, not only of this country, but also on those of the Continent and of America. A friend of many, keen of wit, generous almost to a fault, a man whose word was beyond question.

To how many of us is it given to leave such a record?

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Paints for Iron Work. Engineer, 1899, **88**, [2272], 29.

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PATENTS.

Lubricant. F. Donati and F. Hombostel, Florence, Italy. Eng. Pat. 19,294, Sept. 10, 1898.

See under XII., *page* 925.

Adhesion Fat for Driving Belts and the like. W. Hofschulte, Freren, Germany. Eng. Pat. 14,274, July 11, 1899.

See under XII., *page* 925.

Receiver for Liquefied Gas, or Gas under Pressure. H. G. C. Thofehrn, Rue Miromesnil, Paris. Eng. Pat. 21,084, Oct. 6, 1898.

The receiver is formed of or lined with a material which is impermeable to and unattacked by the gas. One end, or each of the two ends, of the receiver consists of a dished cup, having its concave side outwards and its edges welded to those of the receiver. These edges serve to protect the safety and distributing valves, which are fitted in the cupped end of the receiver, or in opposite ends when both ends are cupped. Both valves are of differential construction, and are controlled by adjustable springs.—R. A.

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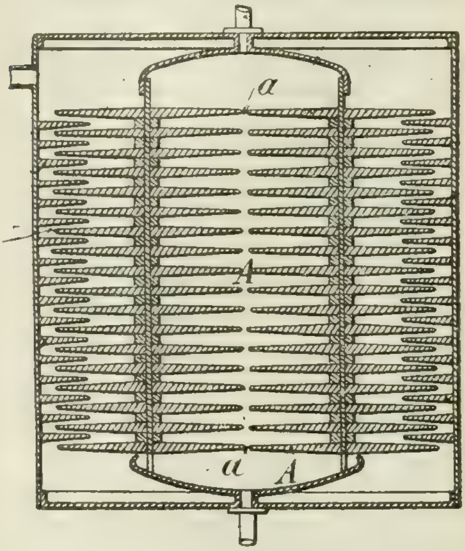
* Any of these specifications may be obtained by post by remitting 8*d*.—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

Liquefying Gases, and Apparatus therefor. **H. G. C. Thofehrn, Rue Miromesnil, Paris. Eng. Pat. 21,085, Oct. 6, 1898.**

The gas, under a convenient pressure, is submitted to a series of alternate compressions and expansions, produced by its passage alternately through narrow openings and large chambers, in such a manner that the heat produced at each compression will be absorbed by the walls of the chambers, the progressive action reducing the gas to the liquefying temperature. The figure shows the apparatus employed. The gas is passed downwards through the narrow apertures *a* in the discs, &c. A, which absorb the heat due to its compression through the apertures. The expansion takes place into the relatively large spaces between the discs. The liquefied portion of the gas is drawn off from the bottom of the apparatus, whilst the remainder ascends between and cools the flanges C, which in turn absorb the heat from the discs A and prevent them from becoming heated.—R. A.

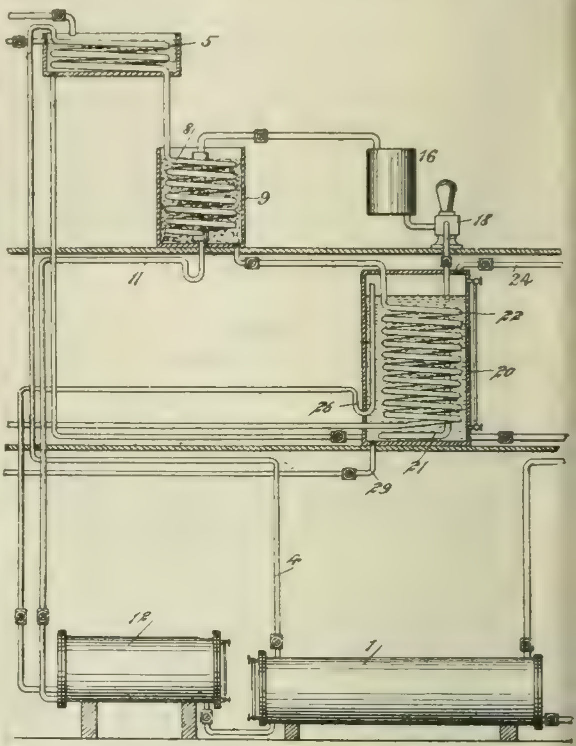


Mixing Difficultly Miscible Liquids or Liquefied Matters, Apparatus for. **M. Julien, Faubourg St. Denis, Paris. Eng. Pat. 23,638, Nov. 9, 1898.**

The apparatus consists of the combination with an impact or jet mixing apparatus of a rotary mixing apparatus, the latter being interposed between the former and the supply pumps. The liquids are more or less intimately mixed in the rotary apparatus, and are then passed into the jet apparatus, where they are subjected to violent impact or shock, produced by fine jets of the partially mixed matters, at a high velocity and under high pressure, meeting each other or a point of impact, so as to effect an intimate and permanent admixture of the different liquids.—R. A.

Valuable Vapours [Hydrocarbons, Bromine, Mercury, &c.], Apparatus for; the Separation and Recovery of. **J. R. Whiting, Stamford, Connecticut, and W. A. Lawrence, Waterville, New York State, both in U.S.A. Eng. Pat. 7612, April 11, 1899.**

The mixture of vapours and air is passed from the receiver 1, pipe 4, and water-jacketed coil 5 to the condensing coil 8, which is immersed in snow and salt. The liquid condensed in this coil passes through the trapped pipe 11 to the receiver 12, whilst the remaining vapours and the air are drawn by the pump 18 through the receiver 16, and are delivered, through the perforated pipe 21, at the bottom of the closed chamber 20, which is partially filled with water. The chamber 20 contains a cooling coil 22, which is fed with the drip from the refrigerator 9. The vapours liberated into the chamber 20 are condensed in rising through the water, and are drawn off through the trapped pipe 26, or, for liquids heavier than water, through the pipe 29, the air being discharged through the pipe 24. —R. A.



Filling for Evaporating, Concentrating, and Condensing Towers, and similar Apparatus. **L. O. Boeing, Vallendar-on-the-Rhine, Germany. Eng. Pat. 12,841, June 20, 1899.**

The filling for the towers, &c., consists of a series of superposed rows of shallow dishes C, Fig. 1, each dish having inclined channels F, Fig. 2, in the under side, which communicate with the upper side through notches D, Fig. 1, in

Fig. 1.

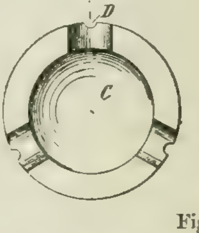


Fig. 2.

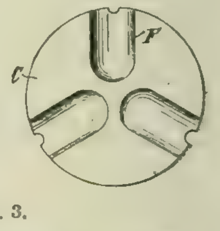
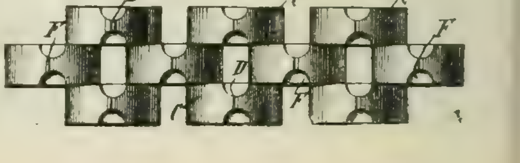


Fig. 3.



the sides and borders of the dish. The dishes are superposed in alternate order, as shown in Fig. 3, the evaporating, concentrating, or condensing surface being increased by the liquid passing over the under surfaces as well as the upper surfaces of the dishes.—R. A.

Drying, Roasting, or Steaming [*Cereals and Granular Goods*] *by Means of Hot Gases, Apparatus for.* F. Gothot, Mülheim-on-the-Ruhr, Germany. Eng. Pat. 23,134, Nov. 3, 1898.

The substance to be treated is placed in a drum, the casing of which is provided with perforated partitions, arranged to form channels, for the purpose of uniformly distributing the heating gases, and leading them into or through the drum.—R. A.

Calcining Furnaces. W. P. Thompson, Liverpool. From W. B. Devereux, Colorado, U.S.A. Eng. Pat. 13,834, July 4, 1899.

There are nine claims for the combination, in parts or entirely, of the following :—A hollow metallic channel or hollow girder built in one or both of the side walls of a calcining furnace, the said girder having three sides closed, the centre of the three being set in the plane of the outside wall and exposed to the outer air, and thus forming the support for the side wall and roof above the said channel, and one side with a continuous open slot extending throughout its length, the slot opening into the interior of the furnace, although the girder need not form the interior wall, but may be protected by a lining. Inside the hollow girders or channels are rollers, upon which rest the arms of a toothed rake extending across the bed of the calcining hearth or hearths; and means are provided for sliding the said rake, by an outside appliance, on the rollers from end to end of the furnace, either with or without a reciprocating motion. The rake is preferably hollow, with hollow teeth, and with flexible connections and a circulating tank for the supply of water to the same for cooling purposes.—A. W.

II.—FUEL, GAS, AND LIGHT.

Peat, Recovery and Utilisation of. F. S. Sprechsaal, **32**, [28], 850—851.

The Mecke-Sander peat cutting and pressing machine is said to have a capacity of 50 to 75 tons per diem, and to yield a very superior product even from mosses that cannot be drained.

In point of calorific power, the ratio between pressed peat and coal is 5:8, but the heating equivalent of 1 cwt. of the coal may be obtained 2*d.* cheaper by using the pressed peat—a saving of three-sevenths of the total cost.

Stiemer recommends the Fairbairn double-hearth system of firing, for peat fuel, and on this principle 26 cylindrical boilers are heated at the Neustadt smelting works. For industries requiring a high temperature and intense flame (*e.g.*, alkali works, pottery and glass kilns, lime kilns, and iron works) peat-gas firing is recommended, whilst peat coke is suitable for blast furnaces, &c., where generator-gas firing is less advantageous. One lb. of pressed peat will vaporise 5—6 lb. of water in a boiler; in glass works 250 lb. of pressed peat are consumed per 100 lb. of glass smelted; 6—7 cwt. of this fuel are needed to burn 1,000 bricks, and 100 lb. to burn 80—100 lb. of lime.—C. S.

Borchers' Carbide Furnace. Electrician, 1899, **43**, 111—112; Science Abstracts, **2**, [10], 692.

The disadvantages of the usual type of furnace, when used for carbide production, are summarised as follows :—1. Loss of carbon dust with waste gases. 2. Loss of carbide by exposure to air in the heated state. 3. Loss of heat in fused carbide.

The improved Borchers furnace consists of a smelting chamber with thin walls enclosed in a water-jacket. The finished block of carbide is left for several hours in the furnace, and the heat which it gives out is utilised for steam generation. By working a series of such furnaces at intervals of two hours or less, a constant supply of heat for steam generation can be obtained.

The carbon required for the formation of carbide is supplied by the electrodes; and the lime is used in the form of lumps, not in a fine powder. When the necessary heat has been attained within the furnace, the lime around the electrodes unites with them to form carbide, and this latter flows away in the fused state. The size of the furnace and the charge of lime are so adjusted that the sides of the smelting chamber are always protected by a layer of unused lime from the action of the intense heat at the centre. The system can be used with either arc or resistance furnaces. Borchers claims for these furnaces that by their use one-fourth of the power hitherto used in carbide production can be saved.

Acetylene, Purification of. J. Pfeifer. J. für Gasbeleucht. 1899, **42**, [33], 551.

A material prepared from chloride of lime and alkaline solution of lead with excess of sodium hydrate, was used in place of simple chloride of lime (which, owing to liberation of chlorine, is apt to cause ignition of the acetylene) for the purification of acetylene at the works of the Hungarian State Railway. A purifier charged with this material, was opened 10 hours after it had been put out of action; on the removal of the topmost grid, which had been charged with lime, a spontaneous outburst of flame occurred, but there was no explosion; indeed the possibility of explosion was excluded under the conditions observed.—J. A. B.

Acetylene, Chloride of Lime Purifying Materials for, Cause of Heating and Development of Chlorine in. F. B. Ahrens. Zeits. für angew. Chem. 1899, [33], 777—779.

Acetylene purified by passage through material containing chloride of lime acquires thereby a small, but harmless, proportion of carbonic oxide, and a variable, but objectionable, proportion of organic compounds of chlorine. The material also frequently heats up violently, and thereupon becomes useless as a purifying agent. The author found that the heating, and the great development of chlorine did not occur when the acetylene was passed through chloride of lime alone, and he traced these phenomena to a reaction between the hypochlorite and the lignin of the sawdust, which latter is mixed with the chloride of lime and water, to constitute therewith a sufficiently porous purifying material. The temperature attained, and the time in which the maximum reading was reached, both varied with the proportions in which chloride of lime, sawdust, and water were mixed together; but as high a temperature as 130° C. was observed in seven minutes, when 20 grms. of chloride of lime, 10 grms. of sawdust, and 9 c.c. of water were mixed. The author concludes that sawdust should be replaced by kieselguhr, powdered coke, brickdust, or lead chromate in the composition of purifying materials containing chloride of lime; or, if it be retained, that it should either be in very large proportion, or the water should be in very small proportion. Objectionable reactions would, he states, thereby be avoided.—J. A. B.

Ferrocyanides in Spent Oxide, Determination of. R. Riechelmann. Zeits. öffentl. Chem. **5**, 188. Chem. Centr. 1899, **2**, [2], 144.

See under XXIII., *page* 949.

PATENTS.

Peat, Working and Manufacturing the same into Briquettes. L. Galecki, J. Lopatin, and P. Lopatin, Warsaw. Eng. Pat. 10,685, May 20, 1899.

The bog or peat pit is closed at one end by a removable weir, and the peat cut by suitable mechanism into comparatively thin vertical layers, and afterwards thoroughly mixed by another machine, the whole of this taking place before the peat is removed from the place. The homogeneous paste obtained, is elevated, and dropped into barrels placed upon a truck moving upon rails alongside the peat canal. These barrels may have knives, so as to further work the peat on its way to the works. The outlet of the barrel is covered by reticulated material, so as to mechanically separate roots and large fibrous pieces. The pulp is then run into filter boxes, and the mass obtained, cut up into briquettes, dried on the surface, and finally laid in layers and subjected to pressure.—R. S.

Gas Producers [*Superheated Gas*]. J. Dymond, Crediton. Eng. Pat. 20,451, Sept. 27, 1898.

"A gas producer constructed with a superheater arranged above the discharging end of an inclined laterally arranged fuel hopper so as to superheat the escaping gas, and with a divided top adapted to form a heater for the air supplied to the producer, the gas escaping from the gas superheater passing into outlet pipes that communicate with a depositing chamber located below the fuel chamber."

A gas producer of the above type "having vertical air passages provided with air and steam injectors, the air and steam pipes delivering into the ashpit above a double bottom," through which the hot gases from the generator escape, thus superheating the air and steam.

Also the combination, in such gas producer, of a hydraulic valve box with the gas-outlet pipe.—C. S.

Liquid Fuel for Furnaces and the like, Apparatus for Effecting, Combustion of. J. S. V. Bickford, Camborne. Eng. Pat. 22,437, Oct. 25, 1898.

The claim is :—"Apparatus for effecting combustion of liquid fuel, comprising a chamber having a removable cover and refractory bed, and an opening at one side, an air pipe projecting into the chamber at the side opposite the opening, and having at its end a hole and slit through its cover, and a slit along its under side, and a pipe leading from a reservoir of liquid fuel and terminating in a bend which opens over the end part of the air pipe."—R. S.

Furnaces [*with Steam Blast*]. M. Hollrieder, Munich. Eng. Pat. 27,596, Dec. 31, 1898.

The claim is for "an improved furnace in which during the open position of the furnace or ash door a steam blast operates, the same having been set in action before the opening of the door, so that either steam alone, or steam and air is forced into the fire-chamber."—R. S.

Smoke-Consuming Furnaces. C. Bolz, Budapest. Eng. Pat. 4614, Mar. 2, 1899.

The principal claim is substantially, an automatic smoke-consuming furnace for boilers wherein the air for combustion mixed with superheated steam is drawn or forced by an injector or ventilator, and is caused to enter above the fire bridge during stoking. But when stoking is finished, and the fire door is closed, the air is caused to change gradually into an under blast, or one which can be blown in as desired as under- or upper-blast. The special features are a three-part hollow body closing the flame tube behind the grate, the lowest part forming the air distributing chamber, into which the steam and air flow, and are sent through valves either as an under blast or an upper blast. In the latter case, the mixture passes into the second horizontal middle chamber carrying the fire bridge, and thence to the upper last chamber forming a semi-cylindrical smoke consumer from which the mixture passes through cross slits into a passage narrowed backwards so as to penetrate rapidly into the passing fire-gas.—R.S.

Liquid Fuel in Steam Generators and the like, Apparatus for Burning. J. J. Kermode, Anfield, Liverpool. Eng. Pat. 22,930, Nov. 1, 1898.

Improvements in the apparatus for burning liquid fuel are described in Specification No. 12,060, A.D. 1898 (this Journal, 1899, 478), in which the oil vapour is given a whirling motion as it passes through a central passage, and is surrounded by a passage through which the air for combustion passes, and which is also given a whirling movement, but in the opposite direction. A branch air inlet is used, which is controlled by a suitable valve, and through which a determinable amount of the heated air passes and at once mixes with and completely vaporises the oil as it enters the central passage of the burners. Three modifications of this device are illustrated and claimed, whilst in a fourth also illustrated and claimed, there are two burners, so connected through two-way cocks, to the oil supply and vaporising pipe and the heated air supply, that the burners may be used alternately without interrupting the action of the apparatus, and with or without the oil vaporiser.—R. S.

Liquid Fuel for Heating Purposes, Apparatus for Burning. J. Smith, Penge. Eng. Pat. 23,718, Nov. 10, 1898.

Each vapour burner consists of a central vertical passage or nozzle for air under pressure, a shallow annular channel surrounding this nozzle for the liquid fuel, and a further central nozzle, above and somewhat larger than the first, through which the fuel is sprayed and atomised into a combined vaporiser and deflector or spreader arranged above, and heated by flame or gases circulating within a surrounding perforated casing or flame chamber. The vaporiser is a metal casing, having its upwardly projecting sides inclined, so that at top they form a narrow elongated opening joined by bridge pieces at each end. One or more of these vapour burners are combined with a reservoir for liquid fuel in communication with a suitable source of supply. The reservoir is provided with a float valve for regulating the supply of liquid fuel. A controlling device for varying or cutting off the supply of compressed air to the burner or burners is provided, and is actuated by the variations of pressure in a steam generator or tube heated by the burner or burners. There are 14 claims.—R. S.

Burners for Burning Hydrocarbons. L. C. Boyle, Barnstaple. Eng. Pat. 19,385, Sept. 12, 1898.

The mixture of liquid fuel and air is blown through a multiple spiral plug, to impart rotary motion, into a spherical chamber, whereby minute subdivision and intimate admixture of the oil and steam is effected, the mixture being finally ejected into the combustion chamber through a nozzle in the spherical mixer. The latter, being partly inserted in the combustion chamber, becomes heated and causes the partial vaporisation of the liquid fuel.—C. S.

Oil, Carburetting or Vapourising, for use in Oil Engines. H. Austin, Alma Street, Birmingham. Eng. Pat. 26,206, Dec. 12, 1898.

The outlet of the nozzle through which the oil is supplied to the carburetting or vaporising chamber is below the level of the oil in the supply tank, and the flow of the oil from the tank is caused by the suction of the engine simply, a back pressure valve being arranged in the communicating pipe. The nozzle has a surrounding cone which is adjustable thereto, and between it and the nozzle, air may be drawn and may enter the carburetting or vaporising chamber with the stream of oil.—R. S.

Combustible Gas, Apparatus for the Manufacture of. H. H. Böhndel, Hamburg, and C. C. Yeaton, London. Eng. Pat. 3290. Feb. 14, 1899.

There is claimed apparatus for producing combustible gas by blowing air over calcined kieselguhr impregnated with a suitable hydrocarbon.—H. B.

Gas Burners. W. K. Stent, London. Eng. Pat. 19,398, Sept. 12, 1898.

The claim is for a regenerative Argand burner with double chimneys and provided with a thin metal ring for dividing the ascending current of hot air below the burner "so that a portion of such current may be diverted from impinging on the issuing gas jets, but may be caused to travel along and sweep the internal periphery of the inner chimney, to prevent the deposition thereon of any smoke, soot, or discolouring matter."—C. S.

Automatic Gas Igniting Apparatus. A. Martini, Berlin. Eng. Pat. 22,901, Oct. 31, 1898.

The inventor claims a method of manufacturing igniting pillules from amalgams of metals of the platinum group, reduction being effected by gradual heating. Also a method consisting in the repeated immersion of an absorbent material (*e.g.*, meerschaum) in salts of the platinum group of metals, the pillules being strongly heated after each immersion and finally reducing the metals by "vapours of organic acids, aldehydes, ketones, and the like, alone or combined with hydrogen," followed by treatment with steam or ammonia and water. Another feature is the attachment to the pillule, of a number of fine wires of two different metals, *e.g.* platinum and palladium, one of which is able to withstand white heat whilst the other is more fusible, in order to increase the rapidity of ignition. Finally, an improved cap is claimed, wherein a swinging plate, normally inclined downwards, is raised by the action of the ascending current of hot gases from the flame and closes the aperture leading to the igniting cap.—C. S.

Ignition Apparatus [Automatic] for Gas Burners. A. Martini, Berlin. Eng. Pat. 15,077, July 21, 1899.

"An improved gas ignition apparatus in which a fixed platinum pillule is employed, and in which a cover plate is provided with an aperture through which the mixture of gas and air issues upward to impinge upon the platinum pillule, so as to effect ignition, the plate being then uplifted by the upwardly issuing heated gases to such extent that the heated gases do not impinge upon the pillule." The pillule may be mounted either on a counterbalanced tipping lever or on a spiral spring, the expansion of which spring by the heat of the flame carries the pillule out of the influence of the hot gases.—C. S.

Igniting Device [Automatic] for Gas Burners. A. J. Sterne, New York. Eng. Pat. 12,481, June 15, 1899.

This invention consists of an igniting body containing finely-divided platinum, surrounded by platinum gauze, or by a number of wires of the same metal, and mounted on a counterpoised pivotted lever. In its normal position, the igniting body stands directly over the gas jet, but when the latter is ignited, the heat of the flame expands a thermostatic bar (preferably of German silver), which swings an intermediate lever engaging with the lever carrying the igniting body, and thus moves the latter away from the flame, the return to normal position being effected automatically, as the thermostatic bar contracts on cooling, when the flame is extinguished. The part of the said bar in contact with the flame is twisted, so as to stand edgewise towards the jet orifice, and thereby prevent distortion of the flame.—C. S.

Automatic Lighting Apparatus for Gas Jets. A. Müller, Berlin. Eng. Pat. 13,308, June 27, 1899.

In this apparatus the claim is for the arrangement of the igniting material in the apex of a conical cap ("to collect the ascending gas,") mounted on a pivotted 3-arm lever, and actuated by the expansion of a compound spiral spring, which, under the influence of the heat in the lamp chimney, causes the lever and cap to tip up out of the way of the ascending hot gases. Combined with the lighter is a chimney cap for converging the gas current on to the igniting material, and consisting of a perforated cover with a central hollow cone, provided with a central escape opening for the gas, whilst, in its sides and in the body part are arranged through openings, "which present a sufficient orifice for allowing of the free escape of the heat given off, and of access to the burner of a sufficient quantity of fresh air."—C. S.

Automatically Lighting Gas, Means or Devices for. B. Fröhlich, Reudnitz, Germany. Eng. Pat. 14,444, July 13, 1899.

In this lighter a globe, &c. of platinum wire is "heated by a bye-pass flame and exposed to the main gas jet, so that when the latter is turned on, the temperature of the globe is raised and the gas is ignited."—C. S.

Incandescent Materials suitable for Use in Electric Lighting, Production of. S. Pitt, Sutton. From The Phar. Inst. Ludwig Wilhelm Gans, Frankfort-on-Main. Eng. Pat. 21,307, Oct. 10, 1898.

Consists of improvements on Eng. Pat. 17,896 of 1898 (this Journal, 1899, 746). A matrix of porcelain or the like, which is not much attacked by weak acid, is covered with a ceramic lustrous preparation of a non-precious metal, which is then burnt in. Upon this coating of metallic oxide is laid a lustrous preparation of one or more of the precious metals, which, after burning in, is coated with a protective varnish of collodion, gutta-percha, or the like. The film of highly infusible metal is detached by means of a solvent which will attack the metallic oxide but not the film of precious metal, and after being shaped, the protective varnish is removed by a solvent or by burning. The metallic film is then coated with "ceramic resin lustre of the luminous earthy metals," which is burnt in.—H. B.

Incandescence Vapour Lamps. H. H. Lake, London. From R. L. Doran, Nashville, U.S.A. Eng. Pat. 264, Jan. 5, 1899.

This specification claims a number of constructional details of an oil lamp in which the heat of the burners vaporises the oil, the vapours afterwards mingling with air and burning beneath a mantle.—H. B.

Incandescence Bodies or Mantles for Incandescence Gas Lamps. M. Koblenzer, Vienna. Eng. Pat. 1538, Jan. 23, 1899.

The embroidering, &c., of trade marks or the like on the mantle fabric before impregnation and burning off, is claimed. —H. B.

Incandescent Lighting, Hydrocarbon Vapour Lamps for. W. S. Proskey, New York. Eng. Pat. 11,743, June 6, 1899.

The eight claims are for combinations of parts of an incandescence oil lamp in which the starting flame consists of acetylene gas, supplied from a generator and mixed with air, prior to ignition. When the lamp is heated, the acetylene is turned off and the oil supply is turned on, the oil being vaporised, mingled with air, and burned beneath incandescent bodies. The heat of the flame continues the vaporisation of the oil.—H. B.

Incandescent Gas Burners. J. B. de Léry, New York. Eng. Pat. 12,150, June 10, 1899.

See patentee's Eng. Pats. 9940 of 1897, 2365 and 19,167 of 1898, and 10,705 of 1899 (this Journal, 1899, 671 and 747). This relates to a modified form of "tassel." "As heretofore made, the coils of said tassels have been open at the bottom, whereas, in the present invention, the tassels are formed of coiled loops, in such a manner that the bend of the loop forms the bottom of the tassel."—H. B.

Incandescence Vapour Lamps. C. C. Bruckner, New York. Eng. Pat. 13,738, July 3, 1899.

The claims are for combinations of parts of an incandescence oil lamp, in which the oil is vaporised in an annular tube surrounding the burner-mouth, the vapours afterwards mingling with air, on the Bunsen principle, and burning beneath a mantle as usual. To start the lamp, the flame of a match is applied to a part of the vaporiser which consists of a coiled tube having a bore not exceeding one-thirty-second of an inch. The oil is supplied from a reservoir by air-pressure as usual.—H. B.

Calcium Carbide, Production of Small Masses of. C. Wehner and M. Kandler, Leipzig. Eng. Pat. 7160, April 5, 1899.

The claims are:—(1) "The process of manufacturing small brick-like masses of calcium carbide, characterised by mixing the carbide in a heated state with sugar or caramel, subsequently moulding this mixture under pressure, and coating the compressed brick-like mass so produced with melted paraffin." (2) "In the production of small brick-like masses of calcium carbide, mixing the carbide in a heated state with sugar or caramel, and subsequently moulding the admixture."—R. S.

Carbide of Calcium, Method of Producing. A. J. Boult, London. From W. S. Horry, Niagara, U.S.A. Eng. Pat. 14,261, July 11, 1899.

"The object of the invention is to provide for the production of calcium carbide of uniform grade and quality, and to increase the output of the finished product," the claim being as follows: — "The method of making calcium carbide, which consists in arranging electrodes of opposite polarity in a substantially vertical position and adjacent to each other, feeding a suitable charge of raw material around the electrodes, causing an electric current to flow between the electrodes, thereby reducing adjacent portions of the charge and producing an initial pool of carbide, keeping the charge around the electrodes of such depths as to retain a considerable portion of the heat generated, and thereby maintaining the pool of carbide in a molten condition until it spreads out laterally beyond the field of reduction, and shifting the carbide and charge vertically with respect to the electrodes, to bring successive portions of the charge into the field of reduction."

—J. C. R.

Acetylene Gas Generators and Containers. W. Walker, Aberdeen. Eng. Pat. 18,178, Aug. 24, 1898.

Water flows from a reservoir through a pipe which enters the bottom of a feed vessel, from which pipes at different levels convey it to generators in which is carbide. The gas evolved from the first generator passes into a gasholder, in which it displaces water, until the head of water exceeds that in the reservoir, whereupon the water in the feed vessel is forced below the level of the pipe leading to the generator, and the supply of water to the latter is thereby cut off, and the generation of gas is thereafter arrested. When the carbide in the first generator is exhausted, the water rises in the feed vessel to the level of the pipe leading to the second generator, which thereupon comes into action.—J. A. B.

Acetylene Generators. J. S. Goodwin, London. Eng. Pat. 19,149, Sept. 8, 1898.

A central gasometer, the bell of which supports a weight when it rises above a certain point, is environed by water receptacles, in the upper part of each of which is a perforated tray supporting carbide. Water poured into one of the receptacles rises to the carbide, and the gas formed escapes to the gasometer until the increased pressure thrown by the weighted bell of the latter forces back the water below the level of the carbide tray in the receptacle. Cocks are provided for putting the receptacles out of communication with the gasometer, and a gas-supply pipe issues from the latter.—J. A. B.

Acetylene Gas Generators. T. R. Waite, Bury St. Edmunds. Eng. Pat. 19,683, Sept. 16, 1898.

Carbide is put into the cavity of a hollow plug, which is then rotated through half a circle, so that the carbide is discharged into water in a generating chamber, above which the plug is mounted in a suitable casing, which may be provided with a removable cap in order to minimise the risk of air entering the generating chamber when the plug is rotated. The generating chamber is supplied with water through a pipe provided with a cock which is controlled by the movements of the bell of the gas-holder into which the gas generated passes. A detachable sediment chamber collects the residual lime.—J. A. B.

Acetylene Gas, Apparatus for Generating. B. H. Wallin and R. de Wendel, both of Gothenburg, Sweden. Eng. Pat. 20,122, Sept. 22, 1898.

Cartridges containing carbide are fed from a retaining spiral band into a shoot, from which they pass through a pair of regulating wheels into the generator containing water. The spiral band is taken up, as the cartridges are discharged, by a drum, and the regulating wheels are also actuated by mechanism, in accordance with the rise and fall of the gas-holder which receives the gas, so that the feed of carbide is regular. Several modifications of the apparatus are described.—J. A. B.

Acetylene, Generator of. G. W. B. Crees, Trowbridge, Wilts. Eng. Pat. 20,626, Sept. 30, 1898.

Water flows from the tank of a gas-holder, through a siphon within the latter, the highest point of which is above the level of the water in the tank, into a bucket which is supported by a float. The water overflows the bucket into a surrounding tube, whence it passes through a pipe to a chamber containing carbide. The gas evolved passes into the gas-holder. The float which supports the bucket is depressed by the bell of the gas-holder when the latter is in a low position, and the water then siphons freely into the bucket, but when the bell rises, the float also raises the bucket until the level of the water therein is above that of the water in the tank, whereupon the flow of water through the siphon to the bucket ceases and the supply to the carbide chamber is interrupted until the bell descends.

—J. A. B.

Acetylene Gas Generator. W. Forrester, Larbert, N.B. Eng. Pat. 20,766, Oct. 3, 1898.

Water is supplied from an overhead tank to generators containing carbide, through pipes provided with valves, which are kept open by weights suspended therefrom. The gas evolved passes into a gas-holder, the bell of which, as it rises, supports the weights and allows the valves to close, thereby interrupting the supply of water to the carbide until the bell again falls.—J. A. B.

Acetylene, Apparatus for Generating. J. W. Bailey and J. Clapham, both of Keighley, Yorks. Eng. Pat. 22,826, Oct. 31, 1898.

Carbide in a generator, is supplied with water from a vessel which serves as washer for the evolved acetylene. From the top of this vessel a partition extends nearly to its bottom, and the siphon pipe by which water passes into and gas escapes from the generator is on one side of the partition, whilst the water-supply pipe by which the water is maintained at a constant level in the vessel is on the other side of the partition. The gas passes from the vessel to a gas-holder. The partition prevents its escape through the water-supply pipe. A second claim relates to the arrangement of carbide boxes, having lids which float when water rises up to them, at different levels in a generating tank, so that they are brought into operation in turn as the water rises in the tank.—J. A. B.

Acetylene Gas, Apparatus for Generating. L. Steiner, Bucharest, Roumania. Eng. Pat. 10,152, May 13, 1899.

Water is admitted, through a valve operated by an external handle, from a reservoir to a carbide vessel, which is placed within a gas-holder, to which the gas escapes as evolved. The gas-holder is fixed within a tank, and at its lower edge communicates therewith through a number of holes, by which water is forced into the tank from the gas-holder when the pressure within the latter increases. At a certain level, a safety pipe is fixed in the tank for the escape of the water forced out by increased pressure in the gas-holder.—J. A. B.

Acetylene Gas, Apparatus for Generating. R. H. and F. Sunderland and G. Marshall, all of Birmingham. Eng. Pat. 13,786, July 4, 1899.

The improvements refer to generators of the type described in Eng. Pat. 6274 of 1899 (this Journal, 1899, 822), and consist in the provision of a water seal between the generating chamber and carbide holder, and of a sleeve for the valve rod; both with the object of preventing escape of gas.—J. A. B.

Acetylene Gas, Apparatus for Generating. O. Imray, London. From F. C. Wilson, Chicago, U.S.A. Eng. Pat. 13,805, July 4, 1899.

Carbide is contained in a number of receptacles which float in water in a generating chamber, by the top of which their flotation is restrained as the water rises in the chamber. The receptacles are perforated at different levels, so that the rising water enters them and causes them to sink in turn. Several modifications are described.—J. A. B.

Acetylene Gas, Apparatus for the Production of. P. va Hamont, Limburg, Belgium. Eng. Pat. 14,124, July 8 1899.

Two gas producers, in which carbide is supported on trays are supplied by pipes entering at their bases, with wate from a tank. The supply is regulated according to the movements of the bell of a gas-holder, into which the gas evolved passes, by means of a cord acting on a tap on the water-supply pipe. The second producer comes into action when the carbide in the first is exhausted.—J. A. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

Petroleum from Grosny (Caucasus), Composition of. K. W. Charitschkoff, Russian Physico-Chemical Society. Chem. Zeit. 1899, **23**, [64], 660.

One part of thiophen was obtained from one million parts of this petroleum, which also contained pentane and isopentane. The fraction boiling at 80°—82° contains a hexanaphthene isomeric with the synthetical substance. The lowest fractions yield on nitration dinitrobenzenes, of which *p* - dinitrobenzene and 1.2.4 - dinitrotoluene were isolated. The large yield of nitro compounds from the Grosny petroleum may prove of technical importance.
—G. H. B.

Petroleum, Purification of. Rev. de Chim. Ind. **10**, [116], 230.

Charles Henry's process for purifying petroleum comprises its deodorisation and decolorisation.

He effects the deodorisation by agitating 100 kilos. of petroleum with $1\frac{1}{2}$ kilos. of litharge, 9 kilos. of potash, and 20 kilos. of water for an hour, then washing with water.

M. Henry has shown that the discoloration of petroleum may be caused either by the lighter or the heavier hydrocarbons. In the first case he bleaches the oil by means of an ozoniser. If the ozoniser be applied to the heavier oils, or those coloured by oxidation in the light, they become more deeply coloured. In this case he treats the petroleum with a reducing agent, such as zinc dust, hydrosulphite of soda, or stannous chloride, which act, however, less perfectly than the ozone in the previous case. Filtering through animal charcoal effects good results, and the author cheapens this process by washing the filter with a little acetone, which dissolves the colouring matter retained in the filter, and can be easily purified by distillation. The filter thus serves for an indefinite period.

M. Charles Henry has also proved by his photometric researches that the discoloration of petroleum has no influence on its lighting capacity, and that the bleaching of it is therefore practically useless.—A. M. F.

Carbolic Acid and other Phenols, Determination of. Riegler. Buletinul Soc. de Sciinte d. Buc. **8**, 51. Chem. Centr. **2**, [5], 322.

See under XXIII., *page* 949.

Petroleum, Determination of Sulphur in. S. Friedländer. Arbb. Kais. Ges.-A. **15**, 365. Chem. Centr. 1899, **2**, [7], 406.

See under XXIII., *page* 950.

PATENTS.

Yellow Prussiate of Potash as a By-Product in the Destructive Distillation of Coal, Process for obtaining. W. Schröder, Wiemelhausen, Bochum, Germany. Eng. Pat. 19,849, Sept. 19, 1898.

The process consists in adding a ferrous salt to the water used for the absorption of ammonia, ammonium ferrocyanide being formed, which is converted into the potassium salt in the usual manner.—D. B.

Shale, Retorts for the Destructive Distillation of. W. Young, Peebles, and J. Fyfe, Glasgow. Eng. Pat. 15,238, July 25, 1899.

The improvement in the construction of retorts to obviate certain difficulties experienced in the ordinary arrangement known as the Young and Beilby system, consists in supplementing the existing process by the application of fire gases to the external surfaces of deep hoppers—to ensure the redistillation of the condensed oils and prevention of the choking of the retort necks—and by the provision of large combustion chambers below the externally heated firebrick sections of the retorts for effecting the combustion of the residual carbon by means of steam and air supplied of suitably adjusted proportions. The combustion chamber is provided with an inclined bottom set so near the angle of rest and movement that the residues, although not self-discharging, may be removed with a minimum of labour. Poker holes passing through the side walls are also provided for detaching the residue when it fluxes.—D. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Logwood, Improved Treatment of. The Textile Manufacturer, 1899, 196. Through J. Soc. Dyers and Col. **15**, [9], 208.

Oxidised logwood extract is prepared from fresh logwood by utilising the oxidising effect which nitrites possess when heated with compounds of the nature of phenol; *e.g.*, 10 kilos. of hæmatoxylin are ground to a paste with 20 litres of water in which $2\frac{1}{2}$ kilos. of sodium nitrite have been dissolved. The mixture is now heated to 85° C., with constant stirring; the melt effervesces, and the colour gradually becomes darker. After three hours' heating the sodium salt of hæmateïn is produced. In a similar manner the hæmatoxylin in fresh logwood may be oxidised to hæmateïn within the wood. For this purpose the logwood is chipped, and after being moistened with from 15—20 per cent. of hot water, is allowed to lie in piles of about a metre in height, for from 4—5 days, being turned each day. The wood is then spread out to cool, and watered with a solution of sodium nitrite of a strength of from 0·2—0·3 per cent. on the weight of the logwood, dissolved in 10 per cent. (on the logwood) of cold water. The heap is constantly turned over to thoroughly mix the materials, and the temperature must not be allowed to rise above 20° C., otherwise the colour will be darkened. The whole process should be completed in from 7—8 days, and the logwood is then ready for use.

When treating extracts, the concentrated extract of fresh logwood, contained in a capacious iron vessel, fitted with a steam coil or jacket and an agitator, should have a solution of the requisite quantity of sodium nitrite added to it. The mixture is then gently heated until the reaction is complete. The quantity of sodium nitrite necessary should be determined by small trials, but the following illustrates the proportions required: to 500 kilos. of Honduras logwood extract, sp. gr. 1·215, add 100 kilos. of water in which have been dissolved 4 kilos. of sodium nitrite and 10 kilos. of sodium carbonate, the latter serving to neutralise any free acid that may exist in the extract. The mixture is stirred for three or four hours at the ordinary temperature, and is then gradually heated to 80° C. for three hours. On cooling, the sodium salt of hæmateïn separates out as a pitchy mass, and can be dried at a gentle heat in a vacuum chamber so as to form a solid extract.—J. G. P.

Brasilin and Hæmatoxylin. J. Herzig. Monatsh. für Chem. **20**, [5], 461—466.

Several papers by other investigators have been published on brasilin since the author's first communication (Monatsh. **19**, 738; this Journal, 1899, 260), and the results of these are discussed in the present paper. The author considers that the formulæ proposed for brasilin, either by Perkin or v. Kostanecki, do not explain its reactions, and also that sufficient experimental evidence has not yet been adduced to enable a formula to be assigned with certainty to brasileïn. In a concluding paragraph he claims priority with regard to the constitutional formula of fisetol dimethyl ether.—T. A. L.

Succinic Anhydride and Pyrogallol, Condensation of. G. v. Georgievics. Monatsh. für Chem. **20**, [5], 450—460.

On heating together succinic anhydride and pyrogallol alone or with concentrated sulphuric acid, the principal product is a dyestuff which gives reddish-brown shades on alumina mordants, but has no similarity to Gallein. Two other products of the reaction are also dyestuffs, one having the peculiarity of only dyeing on alumina, even in presence of an iron mordant. This property is also shown by a dyestuff obtained as an oxidation product of hæmatein. When, however, succinic anhydride (10 grms.) and pyrogallol (20 grms.) are condensed by means of zinc chloride (8—10 grms.) at about 170° C., there are obtained in addition to the foregoing products, Pyrogallolsuccinein, an analogue of Gallein, and a colourless dyestuff, Digallacyl, which gives a yellow with alumina and a grey with iron mordants. The lakes given by the former are rather duller than those from Gallein, whilst the chromium lake is somewhat faster to light. Pyrogallolsuccinein, $C_{16}H_{14}O_8$, purified by means of its sulphuric acid compound, which is decomposed by water, forms a red powder practically insoluble in ordinary solvents, and decomposes completely on heating to 180° C. It does not give any crystalline product on reduction with zinc dust and soda lye, and combines with one molecular proportion of hydrochloric acid to form brownish plates. Digallacyl, $C_{16}H_{14}O_8$, crystallises from alcohol or glacial acetic acid in needles or plates, and turns dark at 270° C. without melting. It is insoluble in sodium bicarbonate, but readily soluble in sodium carbonate and soda lye, the latter giving a yellow solution, which on oxidation turns greenish and deposits a yellow flocculent precipitate. If the solution be at once poured into acid, digallacyl is precipitated unchanged. It dissolves in concentrated sulphuric acid in the cold with a yellow colour, which, on heating or adding ferric chloride, turns an intense violet. If the solution be then carefully diluted, a greenish flocculent precipitate can be filtered off, which again dissolves in concentrated sulphuric acid with a violet colour.—T. A. L.

New Indicator. A. E. Sunderland and A. E. Rhodes. J. Soc. Dyers and Colorists, 1899, **15**, [9], 206.

See under XXIII., *page* 946.

PATENTS.

Azo Dyestuffs [Direct on Fibre ; Cotton Printing], Manufacture of. G. B. Ellis, London. From La Société Chimique des Usines du Rhône anc. G. P. Monnet et Cartier, Lyons, France. Eng. Pat. 19,075, Sept. 7, 1898.

According to this invention, which relates to the production of azo dyestuffs on the fibre, the diazotisable amine and the dyestuff component (phenol, &c.) are mixed in equimolecular proportions with the amount of sodium nitrite necessary for diazotisation. The whole is then stirred into some thickening material, together with some acetic acid, and employed for printing. For example, 1 kilo. of powdered β-naphthylamine, 1 kilo. of powdered β-naphthol, and 0·49 kilo. of sodium nitrite are mixed together and stirred into 100 kilos. of tragacanth or gum mucilage and 1 kilo. of 60 per cent. acetic acid. If the mixture be intended for cotton printing, 5 kilos. of tannin in 50 per cent. acetic acid are added, and, after steaming, the fabric is passed through a tartar emetic bath.—T. A. L.

Colouring Matters [Violet and Blue]. Vidal Fixed Aniline Dyes, Ltd., and L. Haas, Argenteuil (Seine et Oise), France. Eng. Pat. 24,177, May 5, 1898. Under Internat. Convent.

The invention relates to the production of triphenyl- and diphenylnaphthyl-methane dyestuffs by condensing tetramethylated or tetra-ethylated diamidodiphenyl carbinols with aromatic hydrazines in presence of sulphuric acid, subsequent oxidation not being requisite. As an example of the method employed, 108 grms. of phenylhydrazine and 270 grms. of tetramethyldiamidodiphenyl carbinol are dissolved in the cold in 10 kilos. of concentrated sulphuric acid and heated for half an hour to 60°—70° C. The temperature is then raised to 80°—100° C., and in about $1\frac{1}{2}$ hours the melt is poured into water and neutralised with an alkali. The product is precipitated from its cold hydrochloric or sulphuric acid solution by sodium acetate, and dyes wool violet from a slightly acid bath. If the phenylhydrazine be replaced by 182 grms. of diphenylhydrazine a blue dyestuff is obtained soluble in alcohol and dilute acids, which gives blue shades on wool.—T. A. L.

Colouring Matters [Red]. Vidal Fixed Aniline Dyes, Ltd., and L. Haas, Argenteuil (Seine et Oise), France. Eng. Pat. 24,183, July 25, 1898. Under Internat. Convent.

This specification is supplementary to Eng. Pat. 24,177 of 1898 (see above), the patentees now claiming the employment of hydrazines from o-toluidine and certain o- and p-toluidine sulphonic acids, chloraniline and bromaniline, for condensation with tetra-alkyldiamidodiphenyl carbinols. In addition, they find that diamidodiphenyl carbinol itself condenses in sulphuric acid solution with aromatic hydrazines to form red dyestuffs for wool.—T. A. L.

New Colouring Matters [Yellow and Orange-Yellow on Tanning Mordant] and of New Intermediate Products related thereto, Production of. B. Willcox, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 20,063, Sept. 21, 1898.

The patentees obtain new products by condensing m-phenylene or m-tolylene diamine with formaldehyde or benzaldehyde, and further condense these intermediate compounds by heating them with aromatic amines to form yellow dyestuffs for leather. About 122 kilos. of finely powdered m-tolylene diamine are stirred into 2,000 to 3,000 litres of water, and 77 kilos. of a 39 per cent. formaldehyde solution are added. The new intermediate compound, which separates in a few hours, is filtered off, washed, pressed, and dried. It forms a white powder insoluble in water, and sparingly soluble in alcohol, ether, and benzene. For the production of a dyestuff, 50 kilos. are stirred into 300 kilos. of p-toluidine at 100° C. About 200 kilos. of p-toluidine hydrochloride are added, and the temperature is raised to 150°—160° C., and kept thereat for $1\frac{1}{2}$—$2\frac{1}{2}$ hours. The hot melt is then poured into 1,000 litres of water, and the p-toluidine is distilled off with steam. The residue is filtered, and 100 kilos. of saturated sodium nitrate solution are added to the filtrate, when the dyestuff separates as a resinous mass, and can be purified by redissolving and reprecipitating. It dissolves to a reddish-yellow solution in water with a greenish fluorescence, and dyes leather or tannined cotton orange-yellow shades. The base is precipitated by alkali and is insoluble in ether. Similar dyestuffs are obtained by heating the intermediate compound from benzaldehyde and m-tolylene diamine with p-toluidine. In the same way a dyestuff may be obtained from the tetra-amidoditolylmethane of Eng. Pat. 17,971 of 1889 (this Journal, 1890, 935), by heating it with an aromatic amine. For instance, if β-naphthylamine be employed, the dyestuff forms a reddish-brown to dark brown powder readily soluble in water, and dyes tannined cotton a pure yellow.—T. A. L.

Yellow Basic Colouring Matters. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 21,496, Oct. 12, 1898.

Dyestuffs of the phosphine class are obtained according to Eng. Pat. 14,920 of 1897 (this Journal, 1898, 573), by condensing p-amidobenzaldehyde or its substitution products substituted in the amido group with an alphyl derivative of m-tolylene diamine. In the present specification the same initial products are employed, but the condensation takes place in an alcoholic solution and in presence of ferric chloride. In this manner bye-reactions are avoided and an increased yield of dyestuff is obtained. About 55 kilos. of phenyl-m-tolylene diamine hydrochloride are dissolved in 160 kilos. of hot alcohol, and mixed with 24 kilos. of p-amidobenzaldehyde and 50 kilos. of crystallised ferric chloride. The mixture is cohobated for about six hours, when the alcohol is distilled off and the residue is extracted with about 2,000 litres of hot water, and 55 kilos. of nitric acid (62 per cent. HNO_3) are added to the hot filtrate. After standing 24 hours, the dyestuff separates as a heavy yellowish-red powder, which is filter-pressed and dried at about 40°—50° C.—T. A. L.

Indigo Group, Manufacture of Products and Colouring Matters related to the. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 22,459, Oct. 25, 1898.

According to Eng. Pats. 8726 and 10,509 of 1890 (this Journal, 1891, 633), indigo can be obtained by heating phenylglycocoll, its homologues and analogues, including phenylglycocoll carboxylic acid, with a caustic alkali and oxidising the indoxylic leuco product. The fusing operation is conducted out of contact with air, but the patentees now find that in contact with a limited supply of air, isatinic acid or isatin is produced. Moreover, the indoxylic product in a finished melt may be oxidised to an isatin, and these isatin compounds, by condensation with an indoxyl product, yield indigo-red dyestuffs. The production of isatinic acid from a melt is described in the following example :—About 700 grms. of the sodium salt of phenylglycocoll-*o*-carboxylic acid and 1·4 kilos. of powdered caustic soda are mixed and heated to 260°—270° C. until the colour of the melt does not increase in intensity. It is then dissolved in water, a current of air is passed through, and the indigo is filtered off, when the filtrate contains the sodium salt of isatinic acid. On evaporation *in vacuo* this salt separates out, and may be converted into isatin by known methods. For the preparation of indigo-red from the above melt, about 20 grms. of the latter are dissolved in the filtrate after removing the indigo and neutralising with sulphuric acid. The liquid is again neutralised, and is then made alkaline with sodium carbonate and boiled, when indigo-red separates out. The patentees also state that other oxidising agents (nitric acid, potassium permanganate, potassium ferricyanide, manganese dioxide, &c.) may be employed for converting the indoxylic products into the corresponding isatins, which may then be employed for the production of simple or mixed indigo-reds.—T. A. L.

Colouring Matters [Brown, Dark Blue, and Black], containing Sulphur, Production of. A. G. Green, A. Meyenberg, and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 21,832, Oct. 17, 1898.

Hitherto direct cotton dyestuffs of the Vidal Black class containing sulphur have only been obtained by fusing certain constituents with sodium sulphide or sodium sulphide and sulphur. The present invention relates to a new general method for preparing dyestuffs containing sulphur by the use of thiosulphuric acid, the operations taking place in aqueous solution. According to the specification, a new series of dithiosulphonic acids can be obtained by oxidising *p*-diamines, *p*-amidophenols, and *p*-dihydroxybenzenes in presence of two molecular proportions of thiosulphuric acid, by reacting with *p*-nitrosophenol or *p*-nitroso-aniline, &c., on two molecular proportions of thiosulphuric acid, or else by reacting with the unstable oxidation products of monothiosulphonic acids on one molecular proportion of thiosulphuric acid. The dithiosulphonic acids are colourless products, from which dyestuffs can be obtained giving brown, dark blue, and black shades on unmordanted cotton from a sodium sulphide bath. These dyestuffs can be obtained either by oxidising a dithiosulphonic acid in presence of a diamine or amidophenol, and subsequent conversion of the intermediate product by boiling in acid solution, or else by reacting with a dithiosulphonic acid on *p*-nitrosophenol, *p*-nitroso-aniline, or its alkyl derivatives, a quinone-imide or a quinonechlorimide, and conversion of the intermediate compound into a dyestuff by boiling in acid solution. The following example is typical of the method employed :—A solution of 24·8 grms. of *p*-amidophenol in 100 c.c. of water is mixed with 400 c.c. of aluminium sulphate solution (540 grms. per litre) and cooled to 0° C. It is then mixed with 400 c.c. of sodium thiosulphate solution 440 grms. per litre) and oxidised with potassium bichromate (91·6 grms. per litre) and 144 c.c. of 50 per cent. acetic acid at a temperature of 0°—5° C. When the formation of the dithiosulphonic acid is complete, a solution of 49·6 grms. of *p*-amidophenol hydrochloride in 200 c.c. of water is added, and the whole is oxidised at about 15° C. by adding 375—750 c.c. of potassium bichromate solution and 108—216 c.c. of 50 per cent. acetic acid. Subsequently 875 grms. of concentrated sulphuric acid are added, and the mixture is slowly raised to 100° C., and afterwards boiled for about half an hour until the colour does not become any lighter. The insoluble precipitate is then filtered off, washed with hot water, and dried. It dyes unmordanted cotton from an alkaline sulphide bath a deep black, which stands severe soaping.—T. A. L.

Colouring Matters [Dark Brown, Dark Blue, and Black] containing Sulphur, Production of. A. G. Green, A. Meyenberg and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 22,460, Oct. 25, 1898.

In Eng. Pat. 21,832 of 1898 (see above) the patentees have described the preparation of black dyestuffs by reacting with thiosulphonic acid on various components. They now find that the thiosulphuric acid can be replaced by sulphuretted hydrogen, and the following compounds will react therewith :—Paranitroso-aniline or its alkyl derivatives, quinone-imides, quinonechlorimides, *p*-amidophenol, *p*-phenylene diamine, or their alkyl derivatives,—these two latter in presence of an oxidising agent—and such nitroso compounds as on reduction with sulphuretted hydrogen yield *p*-amidophenol, *p*-phenylene diamine, or their alkylated derivatives. For example, a solution of 50 grms. of *p*-nitrosophenol in 400 c.c. of cold water and 55 grms. of caustic soda lye (30 per cent. NaOH) is run into a cold mixture of 240 grms. of concentrated sulphuric acid and 560 c.c. of water, the whole being then saturated with sulphuretted hydrogen at 60°—70° C. When the solution, which is at first red, has become colourless, it is raised to the boil and boiled for some time. The insoluble black precipitate is then filtered off, washed with hot water, and dried. It dyes unmordanted cotton brownish-black from a sulphide bath. The shades obtained from other components vary from dark brown and dark blue to black, and are said to resist severe soaping, acids, and alkalis.—T. A. L.

Colouring Matters [Brown], Manufacture of. H. R. Vidal, Paris, France. Eng. Pat. 26,168, Dec. 10, 1898.

The patentee heats benzene-azo-*p*-cresol together with sulphur and caustic soda, and obtains a dark blackish-brown dyestuff which gives directly dark brown shades on unmordanted cotton. An oil bath, containing a cast-iron vessel provided with an agitator and charged with 40 kilos. of caustic soda, 8 kilos of sulphur, and 30 kilos. of benzene-azo-*p*-cresol, is heated to 180°—190° C. The temperature is then gradully raised to 240°C., and maintained thereat for 6—8 hours. The product thus obtained forms a brittle black substance soluble in water to a dark violet solution precipitated by acids.—T. A. L.

Anthraquinone Dyestuffs [Green], Production of. H. E. Newton, London. From The Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 21,075, Oct. 6, 1898.

According to Eng. Pat. 4961 of 1895 (this Journal, 1896, 194), anthraquinone dyestuffs are obtained by condensing quinizarine sulphonic acid with aromatic amines. The patentees now find that these dyestuffs can also be obtained by condensing 1.4-amidohydroxyanthraquinone sulphonic acids with aromatic amido compounds. The amidohydroxyanthraquinone sulphonic acids can be prepared by treating *α*- or *β*-nitro-anthraquinone sulphonic acid (Ber. **15**, 1514) with sulphur sesquioxide. A mixture of 100 kilos. of *p*-toluidine, 10 kilos. of stannous chloride, 8 kilos. of boric acid, and 10 kilos. of potassium *α*-amidohydroxyanthraquinone sulphonate is heated on the water bath until the original yellow colour turns dark green. The melt is then cooled to 50° C. and poured into dilute hydrochloric acid. The greenish-blue precipitate formed represents the *p*-toluidine salt of the dyestuff, and is insoluble even in hot water. On heating with dilute caustic soda lye, it yields the sodium salt of the dyestuff, which gives very fast green shades on mordanted or unmordanted wool.—T. A. L.

Colouring Matters [Blue]. H. H. Lake, London. From The Farbwerke Mühlheim, Mühlheim-on-the-Maine, Germany. Eng. Pat. 23,615, Nov. 9, 1898.

This is an improvement of Eng. Pat. 18,783 of 1891 (this Journal, 1892, 808), which referred to the production of dyestuffs from 1.4 naphthylene diamine containing as one component naphthol sulphonic acids and as the other α-naphthylamine or naphthionic acid. In the present specification the α-naphthylamine is substituted by one of Cleve's acids (1.3 - or 1.2′ naphthylamine sulphonic acid) and the 1.4 naphthylene diamine by a monosulphonic acid thereof. This latter, in which the sulphonic acid group is in the 2′ or 3′ position, is obtained by sulphonating 1.4-amido-acetnaphthalide. The process claimed is the production of mixed tetrazo dyestuffs by combining mixed diazo-azo compounds of the general formula—

$$-N:N(1).C_{10}H_5y.N(4):N-x$$

(where x is the radicle of 1.4-, 2.3′-, or 2.2′ naphthol sulphonic acid, and y is hydrogen or the sulphonic acid group) with 1.3′- or 1.2′-naphthylamine sulphonic acid. The dyestuffs obtained dye blue shades on unmordanted cotton, which are improved in fastness by diazotising on the fibre and developing with β-naphthol.—T. A. L.

Colouring Matters [*Violet*]. **H. H. Lake, London. From The Farbwerke Mühlheim, Mühlheim-on-the-Maine, Germany. Eng. Pat. 24,830, Nov. 24, 1898.**

The azo dyestuffs obtained from 1.1′ - diazonaphthol sulphonic acids and 1·1′-naphthylamine sulphonic acid have no technical value, and dye wool reddish - violet shades. If, however, they be treated under special conditions with aromatic amines, dyestuffs are obtained which give bluer shades and are faster to light and washing. As an example of the method employed, 15 kilos. of the dyestuff produced from 1.1′.3.4′-diazonaphthol disulphonic acid and 1.1′-naphthylamine sulphonic acid in a weak acetic acid solution are dissolved in 60 litres of hot water. The dyestuff is then precipitated by adding 90 litres of spirit, mixed with 48 kilos. of *p*-toluidine and 7·5 kilos. of hydrochloric acid (20° B.), and allowed to stand 12 days at the ordinary temperature. When the reaction is complete the melt is mixed with ice made acid with hydrochloric acid and diluted with about 500 litres of water, the dyestuff acid being filtered off, when the filtrate should not contain much unchanged primary dyestuff. The acid is then dissolved in 250 litres of water together with about 5·5 kilos. of sodium acetate, and is afterwards salted out. With aniline instead of *p*-toluidine the reaction requires a longer time and the dyestuffs obtained are of a redder shade.—T. A. L.

Oxyanthraquinones and Oxyanthraquinone Sulphonic Acids. **O. Imray, London. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 23,644, Nov. 9, 1898.**

Oxyanthraquinone and oxyanthraquinone sulphonic acids may be obtained free from the corresponding higher hydroxylated anthraquinone derivatives by heating, under pressure, solutions of the alkali salts or alkaline earth salts of anthraquinone sulphonic or anthraquinone disulphonic acids with the hydroxides of the alkaline earths instead of with caustic alkalis. For example, 15 kilos. of sodium anthraquinone sulphonate and 10 kilos. of lime slaked with 120 litres of water are heated in a closed vessel provided with an agitator for 24—30 hours to 170° C. The chocolate-coloured mixture is poured into 300 litres of water, boiled, and precipitated with hydrochloric acid, when *m*-oxyanthraquinone separates as a light green paste. By treating anthraquinone disulphonic acids in the same way, anthraflavic or isoanthraflavic acids are obtained free from the corresponding purpurin. Under suitable conditions of experiment it is thus possible to eliminate only one sulphonic acid group, and thus to obtain the hitherto unknown oxyanthraquinone sulphonic acids.—T. A. L.

Basic Safranine Azo Dyestuffs [*Blue*] *Soluble in Water.* **O. Imray, London. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 23,985, Nov. 14, 1898.**

The blue basic dyestuffs obtained by the action of diazotised safranines on one molecular proportion of β-naphthol are deficient in fastness to alkalis. The patentees find that the diazo compounds of asymmetrical dialkylsafranines react under certain conditions so that two molecular proportions of the diazo compound combine with one molecular proportion of β-naphthol. The blue basic dyestuffs thus obtained are faster to washing and alkalis. For example, 16 kilos. of diethylphenosafranine (obtained by oxidising 1 mol. of diethyl-*p*-phenylenediamine and 2 mols. of aniline) dissolved in 1,700 litres of water are cooled with ice and diazotised with 2·76 kilos. of sodium nitrite and 8·62 kilos. of hydrochloric acid (21° B.). Into this is run, with constant agitation, a solution of 3 kilos. of β-naphthol in 3·8 kilos. of caustic soda lye (sp. gr. 1·437) and 200 litres of water. After standing several hours at the ordinary temperature, the formation of the dyestuff is complete. The mixture is then heated to 60°—70° C.; the dyestuff is precipitated with salt and zinc chloride, filter-pressed, and dried. All the dyestuffs obtained by this method are easily soluble in water, and dye unmordanted vegetable fibres a fast blue, as well as those mordanted with tannin and tartar emetic.—T. A. L.

Dry Alizarine Colours. D. C. Bendix, Silvertown, London. **Eng. Pat. 23,712, Nov. 10, 1898.**

For the purpose of obtaining alizarin in a dry state, but so that it can readily be converted into a paste, the patentee mixes alizarin paste with cellulose in the form of wood fibre, wood or paper pulp, and, after pressing, dries the cakes at 50°—60° C. The method is claimed to be superior to those described in Eng. Pats. 5444 of 1894 and 21,398 of 1897, (this Journal, 1895, 265, and 1898, 344).—T. A. L.

Erratum.—This Journal, 1899, 825, col. 1, line 1. For "Lundmacher" read "Sundmacher."

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Peat Wool. Deutsche Hutmacher Zeit. **30**, [30], 1.

The "Geige" process for manufacturing peat wool, consists in the first place, in stirring the dried peat in a bath of weak soda for several hours, to remove humic acid. It is then redried and passed through opening-machines similar to those in use for cotton, and afterwards subjected to a process of fermentation, to eliminate the starchy and albuminoid matters. The fats, oils, and resins in the fibre are subsequently extracted in closed vessels by means of ether or similar solvents, assisted by heat, pressure being only resorted to when the process is to be expedited. After separation from the solvent, the fibre is thoroughly washed in clean water, extracted by boiling dilute acid or alkali to remove the final traces of tannin, re-washed, and dried, bleaching constituting the final stage, when desired.

The product is claimed to be superior to cotton-wool for surgical bandages, and to form an excellent textile fibre free from harshness, easy to spin and dye, and furnishing a highly absorbent fabric for underclothing, as well as a non-stretching material for driving-belts. It is said that as much as 50 per cent. can be incorporated with natural wool without detection by the unassisted eye and without affecting the texture of the woollen material.—C. S.

Rabbit Skins, Utilisation of, in Europe. [*Hat Making.*] Deutsche Hutmacher Zeit. **30**, [27, 28, 30].

Belgium.—The fur is prepared by washing the skins to remove blood and fat, and plucking out the coarse hair when dry, after which the skins are brushed over with a solution of mercuric nitrate, dried by heat, and shorn in a machine, the fur being sorted into different grades for sale. For hat making, fur of different qualities or colours is blended by "blowing" in a machine about 200 feet long which delivers the light fur, properly mixed, at the further end, whilst the coarser hairs fall to the bottom of the machine.

France.—The method of preparation employed at Pari and Marseilles is about the same as practised in Belgium but in Rheims the coarse hairs are merely shorn down to the level of the fur and not plucked out, the mercury solution being then applied until the fur has shrunk by about one-third of its original length. After drying, the skins are moistened with lime water, to soften them, laid together in pairs (fur sides out), and left in heaps for two or three days to dry previous to shearing.

Germany.—Hare fur is preferred by hat makers, but rabbit fur from England, Australia, France, and Belgium, as well as from native wild rabbits, is also largely used; the method of preparation is the same as in Belgium, &c. At Leipzig the large tame Belgian rabbit is specially bred for its fur.—C. S.

Felt Hats, Materials for Stiffening Brims of Soft. Deutsche Hutmacher Zeit. **30**, [23 and 24].

In applying stiffening dressings to the hat brims, care is necessary to have the latter perfectly dry, otherwise the absorption will be irregular; skill in judging and apportioning the proper amount of impregnating material to each brim is also a prime factor in attaining success.

Cherry gum.—To prepare this gum—which is one of the best stiffenings for thick brims, on account of the elasticity and softness it produces—the lumps are left to dissolve in cold water for 10—14 days, stirring being practised several times daily. The resulting mucilage is passed through a moderately fine sieve and boiled for half an hour, the scum being thrown away. It should then be stored in a cool place, since, if allowed to become sour, the stiffening properties are lost.

Tragacanth is prepared in a similar manner, but should be mixed with other stiffening materials, since, when used alone, it turns dark-coloured goods grey. With an equal quantity of cherry-gum solution, it makes a good stiffening for medium dark-coloured hats, but for very dark shades the proportion of cherry gum should be doubled.

Gelatin, in the condition of a ½ per cent. solution, forms a strong stiffening of excellent character. To prevent deposition on the surface of the felt, it is better to work with a more dilute solution and repeat the impregnation when the first dressing is dry. An addition of cherry gum increases the elasticity, the same end being served by glycerin in stronger solutions of gelatin.

Carragheen moss should be steeped in water for several days, then boiled 2—3 hours and strained. As it gelatinises on cooling, the preparation must be used warm; and, since it keeps badly, only a small quantity should be prepared at a time. The stiffening is of a soft and elastic character.

Plantain.—The seeds swell when steeped in warm water for a few days, and are then gently boiled with five times their own weight of water for 1½—2 hours, more being added at intervals to replace the loss by evaporation. The solution is then strained and kept in a cool place; it forms a very useful stiffening, both used alone and with other mucilages.

The suitability of one or other of the foregoing materials depends largely on the condition of the felt. Thus, close felt gives best results with soft stiffenings, like cherry gum or tragacanth, the more brittle kinds imparting a harsh feel and greyish appearance. Weak brims can be advantageously treated by a double dressing of weak gelatin solution, narrow brims requiring less than broader ones. Specially clarified preparations are requisite for light mode colours on hats that are steamed on the block; and very dry steam must be used, otherwise the brims get dirtied if the blocks are at all defective.—C. S.

PATENTS.

Wools for Washing and Cleansing, Condensed and Automatic Apparatus to be employed in the Preparation of. W. G. Heys, Manchester. From H. Danzer, Paris, and G. Malard, Turcoing, France. Eng. Pat. 13,135, June 24, 1899.

This invention provides in one machine a feeder, steeper, de-suinter or suinter, and an opener. Raw wool is passed down a shoot, so constructed as to supply the wool regularly and evenly to a metallic apron consisting of an endless metal band made up of perforated links, having lugs breaking the pitch on opposite sides. The apron carries a layer of wool about 32 to 39 ins. wide and about 20 to 23 ins. thick. It passes over a series of tanks containing various liquids, and the wool, by means of centrifugal pumps attached to each tank, can be treated by the different reagents in turn.

Arrangements are also made for collecting the spent liquor from each tank in trays above the same, and returning it to its own tank.

The wool is stripped off the apron by a drum having slightly inclined hooks on its circumference.—C. M.

Mercerising Cotton or other Piece Goods, Apparatus for. G. Grandage, Bradford. Eng. Pat. 13,514, June 29, 1899.

Cotton cloth in the piece is engaged on rollers, which conduct it into a mercerising bath, where it passes over pin or grooved rollers. The pin rollers are made of brass, phosphor bronze, or other reasonably non-corrosive material, and the spikes are about $\frac{3}{16}$ in. long. The grooved rollers are made of the same material, but are grooved from the centre outwards. The cloth, by this device, having a tendency to travel outwards with the grooves, is prevented from shrinking. The material, after mercerisation, is passed through squeeze rollers and then through acid- and water-washing tanks, the rollers in each of these being either pin or grooved.

The pressure on the rollers is regulated in one of the ordinary ways.—C. M.

Mercerising Apparatus. P. Jeanmaire, Mülhausen, Alsace. Eng. Pat. 14,329, July 11, 1899.

Cotton fabrics are passed over several rollers through a soda-lye bath of about 25° to 30° B.

After leaving the bath, the fabric is immediately engaged by rollers of about 1 to 3 metres diameter, having a roughened surface.

Arrangements are made by which the fabric passes through a water tank and is afterwards subjected to a spraying action by pipes placed between the rollers. It is then passed through a sulphuric acid bath of 3° to 4° B., and then further washed. It is essential, in order to keep the fabric from shrinking, both in length and width, that, after the cloth once leaves the soda-lye it remains in uninterrupted contact with the several parts of the machine. (See also this Journal, 1898, 149, 240, 345, 452, 573, 756, 840, and 1141; 1899, 36, 136, 267, 490, and 680.)—C. M.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Albumins, Crystalline Form of. A. Wichmann. Zeits. physiol. Chem. **27**, 575; Chem. Centr. 1899, **2**, [7], 393.

See under XVIII. A., *page* 937.

Egg Albumin, Crystallisation of. T. B. Osborne. J. Amer. Chem. Soc. 1899, **21**, [6], 477.

See under XVIII. A., *page* 937.

Chromic Acetate, The Isomeric Forms of. A. Recoura. Comptes Rend. **129**, [5], 288—291.

The author describes, in continuation of his former work (this Journal, 1899, 829), the violet *chromo-diacetic acid*, which is the first stage of the spontaneous transformation of the solution of the normal acetate. He has not been able to procure this in the solid state, because of the ease with which it undergoes further transformation into the chromomonacetic acid already described; but by alkalimetric titration, and by thermal and cryoscopic measurements similar to those already mentioned, he has established its composition as $Cr(C_2H_3O_2.2C_2H_4O_2$. He also describes a green chromomonacetic acid, into which the solution of the violet form changes after many months, which differs from the violet form in colour and in its heat of neutralisation, and which yields a somewhat different chromic hydroxide on boiling with alkali. Apparently, this is a polymer of the violet salt, having the formula $[Cr_2O(C_2H_3O_2)_4](C_2H_4O_2)_2$.—J. T. D.

Gossypol: A Phenolic Compound present in Cotton Seeds. L. Marchlewski. J. prakt. Chem. 1899, **60**, 84—90.

Cotton seeds contain, in addition to oil and a considerable quantity of starch, a carbohydrate, gossypose or melitriose, betaïn, and *gossypol*. The last-named compound is obtained, in an impure state, when crude cotton-seed oil is treated with caustic soda solution, and the solution is acidified with hydrochloric acid (see this Journal, 1897, 530). Its purification is accomplished with difficulty. The method adopted by the author consisted in freeing it from the greater part of the accompanying fatty acids by precipitating these as lime salts, extracting with ether, evaporating the ethereal solution to dryness, and gradually adding the residue to boiling acetic acid, a dark brown amorphous mass separating on cooling and standing. This was several times redissolved in boiling acetic acid, and was ultimately obtained in the form of minute dark brown crystals. To further purify them, the crystals were dissolved in boiling alcohol, a cold 50 per cent. solution of acetic acid was added until a permanent turbidity was produced, and the solution was thereupon heated to the boil and filtered. The crystals which separated on standing, after five or six recrystallisations in this manner, were of a clear yellow colour.

Gossypol forms minute, flat prisms, melting at 188° C., or at 179°—180° C. after drying at 125°—130° C. It is insoluble in water. It dissolves readily in alcohol, benzene, and other organic solvents. Sulphuric acid dissolves it with a red colour: the solution may be heated to 150° C. without change; at 180° C. charring takes place. (The presence of gossypol no doubt accounts for the red colour given to sulphuric acid by crude cotton-seed oil.) Aqueous caustic soda and potash dissolve the compound with a yellow colour, which changes to violet and then gradually disappears, oxidation taking place. A solution in ammonia is more stable. The alkaline solutions reduce Fehling's solution and ammoniacal silver. An alcoholic solution gives, with ferric chloride, a dark green coloration, which changes to dark red-brown on the addition of an alkali. Normal and basic lead acetate give, with the alcoholic solution, dark yellow precipitates, which are not decomposed by hydrogen sulphide or sulphuric acid. Bromine gives a derivative which dissolves in alkalis with a stable yellow colour. An alcoholic solution of gossypol colours iron mordants grey, but the compound produced by the partial oxidation of gossypol in alkaline solution possesses greater dyeing power. Cotton treated with a solution of gossypol becomes mordanted, and may be dyed with basic dyestuffs.

The empirical formula of gossypol is $C_{13}H_{14}O_4$, that of the lead compound being $PbC_{13}H_{12}O_4$.—E. B.

PATENTS.

Chromatic Shade Finder and Index for Use in Colour Blending. G. K. Henderson, Coshocton, Ohio, U.S.A. Eng. Pat. 9256, May 2, 1899.

Three discs, two of which are translucent, are coloured, in gradations ranging from very pale to full shades, respectively red, blue, and yellow, and are mounted, the translucent discs uppermost, on a common pivot. Pointers are attached to them and a scale is placed around them. The proportions of the three colours required to produce a given shade are ascertained by turning the discs round.
—E. B.

Hank Scouring and Dyeing Apparatus. T. Bentley, Bradford. Eng. Pat. 14,429, June 30, 1898.

The materials, namely, hanks of yarn or slubbing, to be scoured or dyed, are placed upon wirework trays in frames, which are then attached to endless chains and immersed in the requisite baths.

A claim is made for the combination of endless chains and worm-driving mechanism as employed for this purpose, with a scouring or dyeing vat, in addition to that of trays for the reception of materials to be scoured or dyed, with a scouring or dyeing frame.—E. B.

Combined Dyeing Machine for Dyeing Cloth and Yarns of all Kinds and Slubbing. R. W. Kemp, Halifax. Eng. Pat. 16,579, July 30, 1898.

The combination of a portable skeleton frame fitted with rollers, and of means for transmitting motion from the upper to a lower set of rollers, with a machine for dyeing cloth, yarn, or slubbing, is claimed.

A skeleton frame, carrying two sets of rollers, upon which the yarn or slubbing, in the form of hanks, is placed, is constructed so that it may be lifted from one and carried to another dye vessel, and may be readily charged and recharged. The rollers in the upper row are turned by pinion wheels, and, by means of straps, drive those in the lower row.

A slight modification is made in the machine, to adapt it for dyeing cloth. This is passed under and over the rollers and over winches which are fixed above the frame, the ends of the piece being sewn together. It is then passed up and down in the dye-bath from end to end of the machine until it is sufficiently dyed.—E. B.

Boiling, Bleaching, and Dyeing Cotton and the like Fabrics, Apparatus for. S. Khrennikoff, Orekhovo, Zonevo, Russia. Eng. Pat. 19,858, Sept. 19, 1898.

A riveted iron boiler is provided with a hinged cover and a steam jacket. The fabric to be treated is wound on a perforated roller, which is then inserted into a frame, and the whole lowered into the boiler, where the fabric is acted upon by the requisite solutions, which are caused to pass through it alternately in opposite directions, whilst the necessary heat is obtained by the supply of steam to the jacket. A very uniform action is obtained, and the duration of the operations is considerably shortened, by the use of the apparatus.—E. B.

Dyeing, Bleaching, Drying, and similarly Treating Yarn in Cops and the like, Apparatus for. A Marr, Manchester. Eng. Pat. 20,562, Sept. 29, 1898.

In vessels and apparatus at present in use for cop dyeing, when the vessel is not fully charged, it is necessary to plug up the holes unprovided with cops, otherwise the liquid would flow chiefly through these holes and not through the cops.

By use of the following apparatus the waste of time consequent upon this plugging is avoided.

The inner cop-bearing vessel is constructed in compartments consisting of series of tubes, arranged in groups, attached to a base plate and opening at the bottom into separate channels which in turn communicate with the main channel, the passage between the two being provided with valves or cocks; so that each series may be put in connection with the pump, or closed at will.

Each tube is bored along its axis for the reception of the perforated cop spindles.—H. I.

Dyeing Yarn in the Form of Cops, Bobbins, or the like, Machines for. W. Coventry, Macclesfield. Eng. Pat. 26,602, Dec. 16, 1898.

The main dye vessel, provided with suitable pumps or other circulating arrangement, carries in its centre a perforated hollow pillar over which the cop-bearing carrier slides. This carrier consists of a box provided with sockets into which the perforated cop spindles are fixed and held in position by a key plate. The box is attached to a tight-fitting sleeve working over the perforated pillar. The liquid is forced by pumps up the central pillar into the carrier box, through the perforated spindles carrying the cops, to the outer vessel, and so into the circulating pump again.

When the dyeing is complete, the box carrying the cops is drawn up the pillar out of the dye liquid, and, coming in contact with certain projections, operates a valve which allows a current of air to be drawn or forced through the cops from a tube inside the central pillar, connected with an air pump, and so the drying of the cops may also be effected.—H. I.

Printing and Dyeing Textile Fabrics. H. A. Costobadie, Broadbottom. Eng. Pat. 167, Jan. 4, 1899.

Diazotised α-naphthylamine or other aromatic amido-compound is printed upon a fabric prepared with an alkali-naphthol compound, and a reserve for indigo is printed upon the colour thus produced, during the same passage through the printing machine. The fabric is then dried and dyed with indigo, either by dipping it upon a frame or by the continuous process, after which it is soured, washed, and dried.—E. B.

Dyeing Combed Wool in Bobbins, Raw Wool, and Cotton, Improved Apparatus for Mechanically. A. A. Vanzeveren, Tourcoing, France. Eng. Pat. 4568, March 2, 1899.

The materials to be dyed are packed between perforated partitions in copper cylinders, and are placed underneath a tank from which dye liquor is discharged through pipes upon them. After passing through the cylinders, the dye liquor is received in a tank at a lower level, whence it is again conveyed to the tank above the cylinders. The cylinders are mounted on trunnions and are inverted when the materials on the upper side have become sufficiently dyed. Those on the lower side are thus brought to the top, where they are more freely exposed to the action of the dye liquor.

A claim is made for "means of automatically supplying dye to the water to form dyeing liquid." The dyewood to be extracted is contained in a vessel with a perforated bottom, through which hot water or liquor from the upper tank is caused to flow. The solution obtained, passes into the lower tank, whence it is forced into the upper tank, part of it again flowing through the dyewood-extracting vessel and the rest through the dyeing cylinders.—E. B.

Dyeing of Textile Fabrics, Improved Process for the. G. Tagliani, Milan, Italy. Eng. Pat. 6249, March 22, 1899.

To obtain cotton tissues with two shades of the same colour, or with different colours, on the two sides, a concentrated solution of a caustic alkali, with or without oxide of aluminium, iron, chromium, manganese, copper, tin, zinc, or uranium, is applied entirely over the surface of one side of them, after which they are dyed. The alkaline solutions may also be applied to both sides of the tissues, the same colour being then produced on both sides, when they are dyed, but with greater rapidity and brilliancy than when the tissues are not thus treated. Designs may also be obtained by printing resists upon the tissues before applying the alkaline solutions. When the tissues are treated with the alkaline solutions on one side only, no contraction takes place in them.—E. B.

Bleaching, Dyeing, and Washing Fabrics with Liquid, and Apparatus therefor; An Improved Method of. B. Thies, Coesfeld, Westphalia, Germany. Eng. Pat. 7903, April 14, 1899.

The defective circulation of the liquid in bleaching and dyeing vessels (kiers) is remedied, according to this invention, by so arranging that the liquid shall be supplied at the top and bottom of the vessel from a tank at a higher level, and also by providing a horizontal circulation of the liquid, effected by means of an external boiler connected by pipes with a series of horizontal openings in the periphery of the main vessel. When charging the kier with goods, these are packed around a hollow cylinder, which is afterwards removed, so leaving a vacant space in the centre of the vessel.

A four-way cock serves to regulate the direction of the circulation.—H. I.

Dyeing, Bleaching, and similarly Treating Textile Fabrics, Feathers, and the like, Apparatus for. A. Urban, Sagan, Germany. Eng. Pat. 11,402, June 1, 1899.

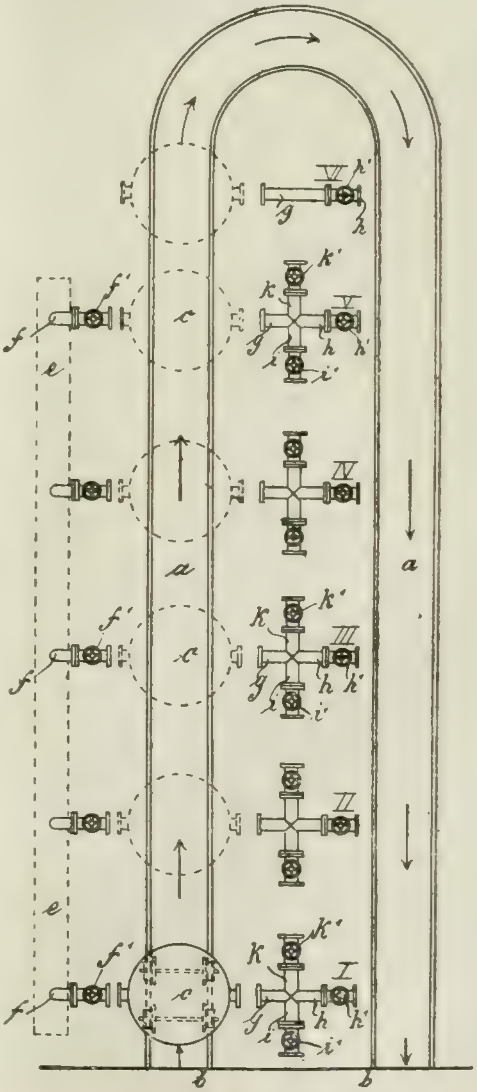
The receptacle for the materials to be treated, is a chamber with perforated top and bottom plates, underneath which is placed a liquor tank. From this the liquors are forced intermittently, by means of compressed air, steam, or a mixture of both, upwards through a central pipe upon the top of the materials. They then flow from the chamber, either directly, or indirectly through a water-seal, back into the tank, taking the latter course when it is desired to prevent the vapours in the tank from acting upon the materials in the chamber, as in the case of woollen stuffs.

Claims are made, amongst others, for means or devices for circulating liquids in dyeing, &c. textile fabrics; for a combination of a water-seal with a liquor tank in connection with the apparatus described; and for a combination with the compressed air- or steam- inlet pipe of a branch pipe provided with a receptacle for dye liquors, &c. which are to be introduced into the dye vessel.—E. B.

Bleaching and Dyeing, Improved Process and Apparatus for. H. Honegger, Duisburg-on-the-Rhine, Germany. Eng. Pat. 11,803, June 6, 1899.

Easily permeable materials, such as yarn, netting, gauze, in the form of spools or balls, are successively bleached, mordanted, dyed, and dried in one and the same vessel.

The spools are placed upon perforated flanged tubes, open at the bottom and closed at the top, the balls upon capsular frames, furnished with hollow spindles, with perforated double bottoms and closing covers. They



Bleaching and Dyeing Apparatus.

are then put into the vessels *c* (see figure), fitted with air-tight covers, air cocks, side inlet- and outlet-pipes, and, between these, perforated double bottoms with a hollow spindle above each perforation, upon which the spool-tubes and ball-capsules are placed. The vessels travel from the warehouse *b*, along rails *a*, past the stationary vessels I—VI, back again to the warehouse, where they are emptied and refilled. Each of the stationary vessels, except the last, is provided with a connecting pipe *g*, terminating in three branches *h*, *i*, *k*, with taps *h′*, *i′*, *k′*. The branches *h* are severally connected with pipes which convey alkaline lye, bleaching powder or chlorine solution, mordant- and dye liquors, and a cold-air blast, while the branches *i* are in connection with a pipe which supplies water for washing purposes, and the branches *k* communicate with a vacuum pipe. The last vessel of the series is connected with the cold-air blast, steam, and vacuum pipes.

The vessels *c*, as they travel along, stop for a time opposite each of the stationary vessels, through which the liquors, &c., necessary for the treatment of the materials they contain, are supplied, being put into communication with them for the requisite time, and then connected with the water and vacuum pipes.

After being bleached, or, if it be desired, bleached and dyed, the materials are dried by means of the cold-air blast from vessel VI. Certain of them, which have subsequently to be spun, after having thus been dried, are damped by placing them in communication, first, with the steam, and then with the vacuum, pipes with which this vessel is connected.—E. B.

Washing, Soaping, Scouring, Mordanting, Bleaching, Dyeing, Sizing, Filling, Mercerising, and Drying Spun or Twisted Fibres in the Thread, Hank, Warp, or Fabric; Machines for. E. J. Brown, Stockport. Eng. Pat. 14,932, July 20, 1899.

This machine consists of a hollow cage having a periphery made up of sector-shaped hollow bars, which communicate with the hollow ends of the cage, and, by this, to the ends of the shaft, which are also hollow. Thus steam can be passed in at one end of the cage, travel through the sector bars, and out at the other end.

At the ends on the inside of the rim of the cage are teeth which gear with a pinion, which, in its turn, gears with a shaft. This shaft carries fans, which serve as agitators, working inside the cage and rotating in an opposite direction to the latter. The whole apparatus is placed in a tank. If threads are to be mercerised, &c., they are placed continuously round the periphery of the cage and a grooved roller situated above. By other suitable rollers they are passed in and out of the machine. If fabrics are to be washed, then the roller above is made plane. To mercerise threads in the hank form, studs are placed at short distances apart round the periphery, and the hanks placed on them. As the cage rotates, the hanks are also made to do so by suitably-geared wheels. The tank can be filled with any desired liquor and heated by the means described. When used as a drying machine, the tank is emptied, and the rotation of the cage and the fans forces air through the threads and fabrics.—C. M.

Fast Colours on the Wool Fibre, Method for the Production of, from Picramic Acid Monoazo Dyestuffs. O. Imray. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/M., Germany. Eng. Pat. 16,893, Aug. 4, 1898.

Wool is first dyed from an acid bath with monoazo-dyestuffs prepared from diazotised picramic acid, and the sulphonic acids of "naphthylamines, naphthols, dioxy-, diamido- and amidooxy-naphthalenes, *m*-phenylene and *m*-toluylene-diamines, amido-phenols and amido-cresols," and is then treated in the same or in a separate bath with chromic acid, a bichromate, chromate, or chromium salt. Brown, olive, and black colours, fast to milling and washing, are thus produced: thus, a black is obtained by dyeing (50 kilos. of wool) with the dyestuff (2 kilos) prepared from diazotised picramic acid and 2·5-ethylamidonaphthol-δ-sulphonic acid, and afterwards boiling in a solution of potassium bichromate (0·75 kilo.).—E. B.

Azo-Colours insoluble in Water, Method for the Production on the Fibre of, in Tints varying from Violet-Black to Dark-Black Tints. O. Imray. From The Farbwerke vormals Meister, Lucius, und Brüning, Hoechst a/M., Germany. Eng. Pat. 17,075, Aug. 8, 1898.

While the diamidocarbazoles, when they are diazotised and combined with β-naphthol, yield brown colours (Eng. Pat. 30,466 of 1897; this Journal, 1898, 1145), diazotised *p*-diamidodimethylcarbazole, in a sufficiently concentrated solution, gives a full violet-black, very fast to soap and light. The printing mixture prepared with it is stable enough for practical use. Resists may be effected with stannous salts or alkali sulphites.

The cotton tissue is prepared with a solution of 30 grms. of β-naphthol, 50 c.c. of caustic soda solution at 30° B., 50 grms. of gum tragacanth paste (60 : 1,000), and 30 grms. of ammonium ricinoleate, per litre, and is printed with a mixture of 60 grms. of sodium acetate, 500 grms. of flour paste, and 500 c.c. of a solution made by dissolving 33 grms. of diamidodimethylcarbazole sulphate and 15 grms. of sulphuric acid at 66° B. in 300 c.c. of water, cooling and adding 100 grms. of ice and 52 c.c. of a solution of sodium nitrite (290 : 1,000), the whole being filtered and diluted to 500 c.c. The printed tissue is dried, washed, and soaped in the usual manner.—E. B.

Striped Cotton Pieces and Cotton Pieces known as Checks, Producing. H. B. Parkinson, Nelson, Lancashire. Eng. Pat. 20,634, Sept. 30, 1898.

By the improved process the yarn for the stripes, either in the form of warp or weft or both, "is dyed a fast colour, that is to say, one which does not readily take another colour when re-dyed in the piece." The ground of the piece, both warp and weft, is composed of yarn in the grey, and in this state is woven into the piece, then the whole of the fabric is dyed any shade or colour required for the ground.—H. I.

Dyeing Black with Logwood. G. W. Johnson, London. From Kalle and Co., Biebrich-on-the-Rhine, Germany. Eng. Pat. 21,575, Oct. 13, 1898.

A method of dyeing logwood blacks is claimed in which "the goods are treated with a mixture of logwood extract and an iron salt, with or without the addition of an organic acid or an acid salt, and also with a solution of nitrite applied either before or after the aforesaid mixture."

The goods are printed with the thickened logwood extract copperas solution to which tartaric acid has been added, and then either passed through a nitrite bath or over-printed with nitrite, or they are first padded with a nitrite solution and then printed with the logwood extract mixture.—H. I.

Mordanting Cotton or other Vegetable Fibre. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 21,833, Oct. 17, 1898.

The goods are mordanted by impregnation with a solution of chrome bisulphite, and then, previous to drying, they are treated with a solution of sodium carbonate or other salt which behaves like an alkali.

The chrome bisulphite may be prepared by dissolving freshly-precipitated chrome oxide in aqueous sulphurous acid containing some sulphuric acid. This solution is made of 15° Tw, and the goods are allowed to soak in it overnight, then wrung out, hydro-extracted to remove excess, and introduced directly into a bath at 60° C., and containing 3 grms. of sodium carbonate per litre. They are allowed to remain therein for 10—15 minutes. After washing and hydro-extracting, they are steeped in a solution containing 100 grms. of Turkey-red oil per litre.—H. I.

Fixing Alumina or Chromic Oxide on Textile Fibres as Mordants, particularly for Dyeing in Adrianople or Turkish Red; Process of. H. v. Niederhaüsern, Rappoltsweiler, Alsace. Eng. Pat. 10,293, May 16, 1899.

The precipitation of alumina or chromic oxide on the fibre by padding the fabric with their alkaline solutions, and then

treating with carbonic acid gas, is claimed. For dyeing Turkish Red the following example is given:—Aluminate of soda solution (5 litres at 15° B.) is mixed with sulpho-ricinate of soda (500 grms.), when a clear solution is obtained. The fabric, after padding with this solution and without drying, is introduced directly into a box charged with carbon dioxide. Aluminium hydrate and carbonate of soda are formed. After completion of this treatment, the goods are stoved at 70° C. to fix the necessary quantity of sulpho-ricinate and then washed and dyed as usual.
—H. I.

Cane, Dyeing and Bleaching. C. D. Abel, London. From H. C. Meyer, jun., Harburg, Germany. Eng. Pat. 23,710, Nov. 10, 1898.

The process claimed consists in treating the cane, either before or during the bleaching and dyeing, with organic acids (best acetic) or alcohols (methyl, ethyl, and amyl), or both combined, whereby the entrance of the colouring matter or bleaching agent into the pores of the cane is facilitated. The colouring matters (such as Acid Green, Chrysoidine, Auramine, &c.) are dissolved, a mixture of alcohol and water and the cane is heated in their solution for 24 hours. Or, if acetic acid be used, the colours are likewise dissolved therein and the solution diluted with from $\frac{1}{8}$th to $\frac{6}{8}$ths its bulk of water. In from 24 to 48 hours the cane will be found to be dyed through.—H. I.

Hair and Furs, Dyeing of. C. D. Abel, London. From The Actiengesellschaft für Anilin Fabrikation, Berlin. Eng. Pat. 25,017, Nov. 26, 1898.

The process for dyeing hair and furs by treatment with solutions of ortho-amidophenol or its chloro- or nitro-derivatives, or mixtures of these compounds with other easily oxidisable compounds, such as pyrogallic acid, para-amidophenol, para-phenylenediamine, and with oxidising agents, is claimed. The following typical example is given:—After mordanting for 12 hours in a solution containing 2 grms. of potassium bichromate and 1 grm. of cream of tartar per litre, the furs are removed, rinsed, hydro-extracted, and dyed in a solution containing 0·5 to 2 grms. of ortho-amidophenol per litre, to which small quantities of hydrogen peroxide and ammonia have been added.

After staying in the bath for several hours, the goods acquire shades of a yellower tint than those obtained from the previously used para-bi-substituted benzene derivatives (see also Ger. Pats. 47,349, 51,073, and 80,814).—H. I.

Yarn Roving, Dyeing, with Indigo Blue. R. Brandts, M-Gladbach, Germany. Eng. Pat. 11,562, June 2, 1899.

According to this invention, the cop of yarn roving is saturated with indigo white, then each bobbin is placed on a hollow spindle and rotated about its own axis. In consequence of this rotation the indigo white in excess is expelled by centrifugal force, after which water is forced into the hollow spindle through the cop for rinsing; the object of this treatment being to allow the oxygen for the conversion of the indigo white to pass through the bobbin from the inside to the outside, and thereby to produce a uniform indigo blue throughout the bobbin.—H. I.

VII.—ACIDS, ALKALIS, AND SALTS.

Ammonia-Soda Industry, Progress of the. H. Schreib. Chem. Zeit. 1899, **23**, 655—658.

The formation of bicarbonate is generally brought about by the use of high-pressure gas rich in carbonic acid, from the belief that absorption takes place more rapidly under pressure, and also that the expansion of the compressed gas diminishes the temperature of the liquid.

The advantage of this has lately been questioned, and fans have been used to drive the gas into the solution. But in this case it is necessary to agitate the solution so as to increase the contact surface.

J. A. Bradburn states that the Solvay tower liquor contains per cubic metre—

—	At the Top Ring.	At the Bottom Ring.
	Kilos.	Kilos.
NH_3, titrated direct	72	20
NH_3, total	76	76
CO_2	67	40
NH_4Cl	11	179
NaCl	249	88

corresponding to a transformation of about 70 per cent. of the sodium chloride.

A distillation and absorption column has been constructed by Hirzel, in which a shaft fitted with scrapers is used to keep the waste liquor pipe clean. The normal work of a 21-ring still corresponds, according to Bradburn, to a production of 12·5 cubic metres of waste liquor with a content of 75—85 kilos. of $CaCl_2$ + 39—48 kilos. of NaCl per ton of soda ash.

Thelen furnaces have come much into use for calcining bicarbonate, and by using two arranged in series, the method of drying may be made a continuous one.

A furnace arranged so as to cause the fresh bicarbonate to fall on a charge already partially dried, prevents the mass from caking on the furnace bed.

Dead-burnt lime appears to be chiefly due to the presence of silica.

Jung and Steuer propose to decompose the calcium chloride by copper sulphate, and to treat the resulting copper chloride solution with sulphuretted hydrogen, forming free hydrochloric acid and cupric sulphide, which can be reconverted into sulphate by oxidation.—G. H. B.

Persulphates, Valuation of. G. H. Mondolfo. Chem. Zeit. 1899, **23**, [69], 699.

See under XXIII., *page* 947.

Ferrocyanides in Spent Oxides, Determination of. R. Riechelmann. Zeits. öffentl. Chem. **5**, 188; Chem. Centr. 1899, **2**, [2], 144.

See under XXIII., *page* 949.

PATENTS.

Yellow Prussiate of Potash as a By-Product in the Destructive Distillation of Coal, Process for Obtaining. W. Schröder, Wiemelhausen, Bochum, Germany. Eng. Pat. 19,849, Sept. 1898.

See under III., *page* 907.

Salt, Improved Process for Purifying. H. Y. Castner, London. Eng. Pat. 21,284, Oct. 10, 1898.

Brine is treated with a small proportion of lime, and then with sodium carbonate, and is heated, that "all the magnesia together with the calcium and also added lime" may precipitate. The brine is then dried, the salt produced usually containing from 1 to 2 per cent. of sodium sulphate, which latter is removed by washing with a saturated solution of sodium chloride, which is stated to be capable of taking up about 6½ per cent. of sodium sulphate at 34° C. The washing solutions may be cooled to about 0° C. when most of the sodium sulphate will crystallise out; or they may be evaporated to produce an inferior quality of salt.
—E. S.

Hydrosulphurous Acid and Hydrosulphites, Preparation and Manufacture of. J. Grossmann, Manchester. Eng. Pat. 21,126, Oct. 7, 1898.

As the easily soluble hydrosulphite compounds are unstable, the inventor prepares the more difficultly soluble hydrosulphites, and especially calcium hydrosulphite, from which when required, hydrosulphurous acid or a soluble hydrosulphite may be obtained by use of sulphuric acid or of suitable acid salts. Calcium hydrosulphite may be obtained by precipitating a solution of a neutral or alkaline sodium hydrosulphite with a suitable soluble calcium salt, such as calcium chloride, and a little milk of lime. Or calcium hydrosulphite is produced by heating calcium sulphite paste to about 30° C., and then adding stated proportions of zinc dust and of sulphuric acid of 1·225 sp. gr. The filtrate of the product, containing the soluble acid hydrosulphite, is precipitated by milk of lime. Or a less pure product is obtained by adding the milk of lime to the unfiltered mixture. The calcium sulphite may be replaced in the process by barium sulphite, zinc sulphite, or similar other sulphites, to obtain the corresponding hydrosulphites. —E. S.

Bisulphite of Soda, Manufacture of. F. M. E. Basse and G. Faure, La Fage, France. Eng. Pat. 23,978, Nov. 14, 1898.

A close vessel, provided with a hopper at the top, and with a double bottom, has one pipe for admitting sulphur dioxide gas to a layer of water at the bottom, another pipe entering horizontally at the side and curved upwards against the double or superior bottom, through which steam is passed, and an exit pipe for leading off waste or excess gases from the upper part of the vessel. Sodium carbonate is charged in through the hopper, and rests upon the upper perforated bottom. Sulphur dioxide being passed in, decomposes the sodium carbonate by aid of the steam, and the bisulphite solution formed, drains down into the water beneath, until this becomes saturated, or even deposits crystals of the bisulphite. Two or more similar vessels may be arranged in series so that the effluent gases may be deprived of all their sulphur dioxide. It is assumed that sulphuretted antimony ore is roasted to supply the gas, in which case metallic fumes are arrested by suitable intermediate apparatus.—E. S.

Borax, Manufacture of. C. Bigot, Hamburg, Germany. Eng. Pat. 862, Jan. 13, 1899.

Boric acid and ammonia are mixed with sodium nitrate in the proportions indicated by the following formula :—

$$2B_2O_3 + 2NH_3 + Na_2N_2O_6 + H_2O = Na_2B_4O_7 + (NH_4)_2N_2O_6.$$

Just sufficient water is added to dissolve the ingredients, which become warm, and on cooling deposit crystals of borax, which are separated from the solution of ammonium nitrate in a centrifugal machine.—E. S.

VIII.—GLASS, POTTERY, ENAMELS.

Glass and Glaze, Metallic Lustre for. M. W. Sprechsaal, **32**, [19], 576.

The yellow coloration imparted to glass by a mixture (1:3) of a salt of silver and some inert diluent, such as ochre, chalk, lampblack, &c., under the influence of heat, can be converted into a metallic lustre, by exposure to the action of reducing gases in a muffle, the glass still retaining its yellowish tinge when viewed by transmitted light. The shade and brilliancy of the lustre vary according to the silver compound employed, the nitrate furnishing a yellow of merely slight lustre, whilst silver chloride gives a more greenish shade and gold lustre, and the sulphide a yellow with a silver lustre.

A square air-tight sheet iron muffle is the best furnace to use, and in this the decorated articles are arranged on open shelves (sieves) leaving a space about 5—6 cm. deep at the bottom. The muffle having been heated to the desired temperature, a pan charged with lumps of coal is introduced in the bottom space, and heating is continued for 6—8 minutes with a stronger fire than before, at the end of which time the fire is drawn.—C. S.

Lead-Glass Manufacture. Diamant, **21**, [16], 337—338.

Good semi-crystal lead-glass is furnished by the following mixtures :—Sand, 100 parts ; potash, 35 (or 24) ; lime, 10 ; minium, 15 ; nitre, 4 (or soda 8) parts. Prolonged fusion at a moderate heat ensures the best results, the first charge being left in the kiln for 6—8 hours, after which the pots are filled up and reheated for a further 5—7 hours, until the molten mass appears clear ; gas firing in open pots facilitates uniformity of fusion, and yields a finer product than any other method.

Lead-glass is the best for decorating by etching, engraving, or cutting, and is largely used for decorative purposes in connection with petroleum-, gas-, or electric-lamps, lending itself also to embellishment by flashing over with delicately tinted glasses.—C. S.

Enamel Glass. Sprechsaal, **32**, [13], 384—385.

For heavy glassware it is preferable to produce opacity by flashing clear glass over with so-called enamel glass rather than to employ opaque glass throughout, since by the former plan a single clear glass mass will serve for the production of ware of various colours, which will, moreover, be handsomer in appearance owing to the practice of flashing the enamel-glass again with a layer of clear glass. The chief difficulty in flashing is to have both glasses of uniform coefficient of expansion, to prevent cracking in annealing.

For white enamel glass, an opaque white glass mass is fused along with alabaster glass cullet (about 25 per cent.) care being taken to prevent the mass from boiling over through the effervescence due to the contained arsenic. This danger, if imminent, can be averted by the application of cold water. After fusing, the glass is quenched in water and remelted, being finally "blown" some 10—15 times by stirring with wet sticks. The coloured enamel glasses are prepared in the same way, and with the ordinary opaque-glass pigments, though these should be in larger proportion than usual, to produce the requisite opacity.—C. S.

Opaque, Coloured Glass. Sprechsaal, **32**, [11], 322—324 ; [12], 352—353.

Opaque glass can be tinted *blue* by the aid of cupric oxide, carbonate, or sulphate, cobalt oxide, nickel oxide, and smalt in varying proportions. *Green* is furnished by mixtures of cupric oxide (or sulphate) with ferric oxide, potassium chromate, sodium uranate, or barium chromate.

For *yellow*, either silver, sulphur, uranium, antimony, or cadmium is employed, uranium being the best. Carbon must not be used for reducing the alkali sulphide pigments.

Rose red (rose Dubarry) is obtained by using metallic gold (or ruby glass) and flashing the resulting glass over the opaque ware, the flash-glass being prepared in the shape of a funnel, and the white glass blown in. The colour does not develop properly until several times heated and recooled.

Various shades.—Yellowish-brown and *flesh tints* are obtained by using manganese dioxide ; *agate* by a mixture of manganese dioxide and sodium uranate deepened, if required, by nickel oxide : *fawn* and *chestnut* by manganese dioxide and ferric oxide ; *coffee brown* by manganese dioxide ; *tourmaline* by cupric oxide and ferric phosphate ; *slate grey* by manganese dioxide, cupric oxide, and cobalt oxide, the substitution of nickel oxide for the last named producing *stone colour ; ivory*, by red ferric oxide and manganese dioxide ; *mouse-grey* by iron scale (magnetic oxide) and nickel oxide ; *violet*, by manganese dioxide, cupric oxide, and smalt.—C. S.

Opaque Glass. Diamant, **21**, [19], 408 ; [20], 429—430.

Various kinds of glass can be used as a basis for opaque glass—pure alkali-lead glasses, as well as alkali-silicates containing much or little lime. In selecting the fundamental glass, however, the behaviour of the material employed to produce opacity should be considered, since lime, for instance, counteracts the effect of aluminium fluoride, and should therefore be replaced, in such cases, by lead oxide, and fluorspar and guano already contain sufficient lime to form a lime-glass ; whilst on the other hand when bone ash is used, the mass requires to have a highly basic character.

Ivory glass, which first becomes opalescent on cooling, may be made from :—Sand, 50 parts ; potash, 20 (or 21) ; bone-ash, 15 ; lime, 6 ; nitre, 1 (or arsenic, 1) part.

Cryolite imparts to glass a handsome enamel-white opalescence. The mass may be compounded of :—Sand, 50 parts ; soda ash, 8 (or 6 and potash 4) ; lime, 4 ; cryolite, 7 ; nitre, 3 ; minium, 3 (or zinc white, 2) parts. Since, however, the fluorine attacks the glass-pots and thus leads to the contamination of the glass, felspar, or alumina, is sometimes added, the composition of the mass being modified, as follows, to :—Sand, 50 parts ; potash, 4 (or 5) ; soda ash, 6 (or 5) ; cryolite, 7 ; felspar, 5 (or alumina, 5) ; lime, 5 ; and nitre, 3 parts.

A cheap substitute for cryolite is fluorspar, which, however, has to be neutralised by alumina to prevent corrosion of the glass pots and develop opalescence. In colour, spar-glass is more milky than when cryolite is employed, but is whiter and more translucent, and therefore superior for lamp shades; a tendency to roughness and dulness when blown out thin can be corrected by increasing the proportion of lead oxide. A typical mass is prepared from :—Sand, 50 parts ; soda ash, 10 (or 8) ; potash, 3 (or 4) ; fluorspar, 10 ; alumina, 5 (or 10) ; nitre, 2 (or 3) ; zinc white, 2 (or minium, 3) ; felspar, 10 (or 0) parts. A superior quality is obtained by a mixture comprising cryolite and fluor spar :—Sand, 50 parts ; soda ash, 6 ; potash, 4 ; cryolite, 4 ; fluorspar, 5 ; felspar, 6 ; nitre, 2 ; and zinc white, 2 parts.

Medium kiln temperatures are best for spar glass, the pots being less corroded and the glass obtained being more opaque than when greater heat is employed ; for this reason spar-glass should be fused in a kiln by itself.

A mixture of sodium fluoride and aluminium fluoride, or alumina, is also cheaper than cryolite, though a larger proportion has to be employed owing to the lower stability of the fluorine compound. The mass is compounded of :—Sand, 50 parts ; potash, 6 ; soda ash, 6 ; sodium fluoride, 6 (or 4) ; alumina, 8 (or 5, along with felspar, 6) ; nitre, 1 ; minium, 3 (or zinc white, 2) ; lime, 3 (or 0) parts.—C. S.

Glass Mirrors, Silvering by the Edel Process. Deutsch. Chemische Zeit. 1898, 36. Diamant, **21**, [18], 385.

Two solutions are prepared, one of 30 grms. of silver nitrate in 240 grms. of distilled water, which is then treated with ammonia, until the precipitate first formed is redissolved, filtered until perfectly clear and made up to 480 c.c. with water; the other being obtained by dissolving 0·75 grm. of potassium sodium tartrate in 300 grms. of water, and boiling, whereupon 0·166 grm. of silver nitrate is stirred in and boiled for 10—15 minutes until grey. After filtration this solution also is made up to 480 c.c. and both are kept in a cool dark place. For use, equal parts (30 c.c.) of the solutions are mixed, diluted with 120 c.c. of water and poured over the surface of the glass to be silvered. In about an hour the whole of the silver will be deposited, the glass being then rinsed with water, set up on edge to dry, and finally backed with a protective coating of asphalt varnish.—C. S.

Glass Paving Blocks. Diamant, **21**, [13], 271.

See under IX., *page* 918.

Photographing on Glassware. Diamant, **21**, [18], 385.

See under XXI., *page* 945.

Kaolin, Mining and Preparation of. T. C. Hopkins. Eng. and Mining J. 1899, **68**, [9], 245.

Kaolin occurs in two distinct forms : (1) "residual" kaolin, when it is present in the position of the original felspar and usually in the form of a vein ; and (2) "transported" kaolin, when it has been carried away by streams and deposited, the sedimentary beds varying greatly in thickness and extent, but being generally of greater lateral extent than the deposits of residual kaolin. The "residual" kaolin furnishes the purer finished product as its impurities—crystalline quartz, mica, and undecomposed felspar, &c.—are nearly all in coarse particles, which can be separated by washing ; whilst the "transported" kaolin, although purer in the natural condition, contains impurities—iron oxide, calcium carbonate, &c.—which are difficult to separate by washing.

Kaolin is mined in the United States by means of vertical shafts, 25 or 30 ft. in diameter, lined with small pieces of timber about 3 in. thick, 10 or 12 in. wide and 2 ft. long.

The washing of the kaolin, to remove as far as possible the coarse material and the foreign impurities, is carried out in different ways, all of which, however, are based on the principle of flotation, the material being thrown into water when the clay particles being finer and lighter than the impurities remain longer in suspension.

It is stated that most of the washing plants in use are rather crude affairs, and that proper attention is not always given to the different requirements for special uses and adapting the treatment to them. For the preparation of high-grade kaolin, as for the paper trade, the grit may be separated by elutriation and settling in the washing troughs, settling vats, &c., and iron can be avoided by selection of material. It is difficult, however, to separate the almost microscopic plates of mica, which become suspended in the washing process. They may be partly eliminated by passing the material through a very fine-meshed silk netting.

The cost of mining and washing kaolin, and the yield of the finished product, vary considerably in different localities.—A. S.

Egyptian Porcelain, Composition of. H. Le Chatelier. Comptes Rend. 1899, **129**, [7], 387—388.

There has been considerable discussion as to whether the ancient Egyptians manufactured a true porcelain. Brongniart concludes that they did not, and asserts that all the specimens of porcelain found in Egypt have been of Chinese origin. The author, however, has recently examined a fragment of a funeral statuette found at Saggarah (Memphis), which he states is undoubtedly of porcelain, whilst the hieroglyphics on it point to its Egyptian origin. The material is said to be hard and translucent, and of a pale blue colour. Its composition, which differs materially from that of Chinese porcelain, is as follows :—Sodium oxide, 5·8 ; copper oxide, 1·7 ; lime, 2·1 ; alumina, 1·4 ; iron oxide, 0·4 ; silica, 88·6 per cent.

He has reproduced a precisely similar porcelain from a paste consisting of blue glass, 40 parts ; fine sand, 55 parts ; and white clay, 5 parts. The blue glass was prepared so as to have a composition corresponding to the formula, $3·3\ SiO_2, 0·23\ CaO ; 13\ CuO ; 0·64 Na_2O$. When baked at 1,050° C., this paste produced a pale blue mass, which became green when the temperature was raised to about 1,250° C. Owing to its containing so small a proportion of clay, the moist paste had but little plasticity, and was only suitable for modelling compact objects, such as the Egyptian statuettes were.—C. A. M.

Porcelain, Over-Glaze Enamels for Highly Fired. C. B. S. Sprechsaal, **32**, [18], 542.

A fritt is prepared from equal parts of Norwegian felspar and minium, and of this 132·5 parts are taken for the enamel mass, the other constituents being: sherds, 347 parts; quartz, 305·7; burnt Zettlitz kaolin, 41·3; and Wunsiedel calc spar, 173·5 parts, all fritted together to prevent shrinkage.

When applied somewhat thickly, in a dilute gum arabic or glycerin medium, on glazed porcelain, the enamel—coloured as below—fuses like Seger cone, No. 5, but on stoneware glaze at a much lower temperature (cone, No. 01). Various special colours are specified and proportions given.—C. S.

Black Terra Cotta. H. Le Chatelier. Comptes Rend. 1899, **129**, [7], 386.

The manufacture of black pottery is widely developed, especially in Germany, where it is used for industrial products, and in Denmark, where it is employed in art ceramics. The articles are baked in a confined atmosphere charged with tarry vapours, and the coloration is due to an impregnation of carbon. Simultaneously, however, an adherent film of graphite is deposited on the surface, which, although of use for industrial products, since it increases their impermeability, is objectionable in artistic products, and has to be removed by hand.

The author has found that the deposition of carbon in the interior of the paste depends to a large extent on the presence of iron, and that if the latter be absent the product only acquires a grey colour, whilst nearly the whole of the carbon is left in the external crust. Oxide of iron possesses the property of facilitating the decomposition of carbon dioxide and hydrocarbons, and lowering the temperature at which the deposition of the carbon or condensed carbides commences.

He has obtained the most satisfactory results by the action of acetylene on earths containing about 2 per cent. of iron oxide, like those for instance of Rambervilliers or on purer clays containing a suitable proportion of colcothar. The acetylene is allowed to act for about 15 minutes at a temperature between 450° and 480° C. At a lower temperature the decomposition is too slow, whilst at a higher one the carbon is deposited on the exterior as well as in the interior of the paste. After this impregnation, the articles are baked in crucibles filled with powdered charcoal or coke. It is stated that sandy clays baked at 1,200 C. acquire a hardness comparable with that of porcelain.—C. A. M.

PATENTS.

Artificial Stones Employed in Jewellery, Manufacture of. S. Grossiord, Aux Moussieres (Jura), France. Eng. Pat. 18,689, Aug. 31, 1898.

The stones are made of strass (which may be colourless, coloured, or both varieties combined), and window glass, which are welded together into a single block, and then cut. Thus, a plate of glass may be welded between two blocks of strass, and then cut to imitate a diamond. In this case, the glass forms the part technically known as the "crown," while the strass blocks form the parts known as the "table" and the "pavillion." Or a plate of strass may be welded between two pieces of glass or to a single piece. The glass is said to increase the reflection from the cut faces.—H. H. B. S.

Enamelled Cloisonné. T. Pfister, London. Eng. Pat. 18,729, Sept. 1, 1898.

The process is as follows: The design to be copied is placed beneath a transparent foundation plate, or if an opaque plate be used, it is glued to it. The outlines or contours are then formed of wire strips, and secured to the plate by an adhesive material soluble in water. The spaces between the contour strips are now partly filled with powdered glass and backed with clay. The foundation plate is then removed by hot water, when the superfluous glass powder falls out, leaving hollow spaces or cells between the contours. These cells are filled with soft glass of the required colours, which is then fused. The contour strips are either protected with enamel paint before the fusing, or the surface of the work is ground and polished after the fusing. In the latter case the strips are gilded or bronzed.—H. H. B. S.

Terra Cotta, Pottery, and the like, Manufacture of. H. H. Lake, Middlesex. From V. Micheli, Florence, Italy. Eng. Pat. 3307, Feb. 14, 1899.

In manufacturing terra cotta, pottery, bricks, &c., the earths, instead of being used in their natural condition, are first dried, pulverised, and burnt, and then used for making the articles. The advantages of this method are said to be non-liability to deformation, and the possibility of using earths which for the usual method of manufacturing would be unsuitable.—H. H. B. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Gypsum, The Setting of. K. Zulkowski. Chem. Ind. **22**, 1899, [15—16], 349—352.

The conclusions arrived at by the author are as follows: (1.) In the setting of ordinary burnt gypsum, 2 mols. of water are taken up, resulting in the formation of the lime salt of hexahydroxyl-sulphuric acid, $S(OH)_6$. (2.) Gypsum burnt at a moderate red heat absorbs only 1 mol. of water, forming the lime compound of tetrahydroxyl sulphuric acid $SO(OH)_4$. (3.) In both cases the water plays a double part, the first being a solvent action upon the original easily soluble lime compound, and the second a chemical combination resulting in the formation of a more insoluble body, which crystallises and sets to a compact mass.

—H. H. B. S.

Mortar Testing. T. Behrmann. Rigaer Ind. Zeitg. 1899, **25**, 97; through Chem. Zeit. Rep. 1899, **23**, [27], 265.

The author remarks that in the case of mortars, tests made by compression are preferable to those made by tension. He describes a series of experiments made to compare the compressive strength of Roman and Portland cement mortars with that of lime mortar. The results show that the compressive strength acquired by the lime mortar in one year was reached in four weeks by Roman cement mortar 1:3, and in one week by Portland cement mortar 1:7. Further, that the addition of one-third by volume of Portland cement to Roman cement, increased the compressive strength of the latter at seven days, threefold, whilst equal parts of Portland and Roman cement produced a mortar which acquired in the same time a compressive strength five to six times that of pure Roman cement. A comparison of the strength of the briquettes after seven days with that acquired after a year, showed that the less the strength was at first, the greater was the increase during the year.

—H. H. B. S.

Glass Paving Blocks. Diamant, **21**, [13], 271—272.

The Garchey glass paving blocks laid down in Lyons some months ago are reported to wear very well, only a few having become chipped. The blocks have a superficial area of about 64 square inches, the face being divided into 16 squares by cross furrows so as to afford better foothold. They are set close together to prevent percolation, and are stated to be more durable than granite, whilst cleaner than wood blocks or asphalt. A large factory has been erected near Lyons for producing these blocks, as well as plain and ornamental blocks for building purposes.—C. S.

PATENTS.

Precipitated Sewage Sludge [as Cement], Utilisation of. W. R. Hutton, jun., Whiteinch, Lanarkshire. Eng. Pat. 20,620, Sept. 30, 1898.

The dried sludge, mixed with limestone and coal schist, is calcined to form Portland cement clinker.—L. A.

Artificial Stone, Manufacture of. C. W. Stevens, Chicago, U.S.A. Eng. Pat. 9816, May 9, 1899.

The principle of this invention consists in a novel method of moulding the artificial stone, which may be carried out in two ways: either the stone producing compound may be moulded in a wet state and the mould (formed of dry moulding material) used as dry as possible, or the stone-producing material may be used in the form of a dry powder and the mould in a wet state. In the first case, the dry moulding material absorbs the surplus moisture from the stone compound, whilst in the second case the dry stone compound extracts the moisture necessary to produce chemical action from the wet mould. The method is said, owing to its simplicity, to render unnecessary the employment of skilled labour.—H. H. B. S.

Solid Materials from Tar and other Substances, Production of. C. Dörr, Germersheim, Germany. Eng. Pat. 13,146, June 24, 1899.

The claims are for (1.) "The process of production of solid bodies having hardness between that of wood and stone, composed of a mixture of finely divided inorganic materials, such as sand, gravel, or the like, or organic materials, such as sawdust with from 10 to 30 per cent. of tar, heating the same to from 150°—200° C. to remove the more volatile constituents from the tar, and finally pressing the mass before it is completely cold." (2.) "A solid material composed of a mixture of sand, gravel, or the like, with 10 to 30 per cent. of tar, boiled until the mass appears as a dry mortar, and subsequently pressed." (3.) Or "of a mixture of sawdust or the like with 10 to 30 per cent. of tar, boiled" and pressed as in (2). (4.) Or " of a mixture of sand, gravel, or other inorganic material, with sawdust or other organic material and 10 to 30 per cent. of tar, boiled" and pressed as in (2).—D. B.

Cement, Lime, and like Materials, Rotary or Revoluble Furnaces or Kilns for Burning. F. C. W. Timm, Hanover. Eng. Pat. 12,664, June 17, 1899.

The furnace consists of a metal cylinder, set at an inclination, and surrounded by a second cylinder fixed at a certain distance away, leaving an air-space between the two. The two cylinders are mounted so as to revolve together, by means of supporting or running rings, one of which is used for driving. A current of air or other cooling medium is caused to pass through the space between the cylinders, with the object of keeping the walls of the furnace cool, so as to prevent the material to be burnt, from baking on to the inner walls of the kiln. To allow of expansion without the risk of the furnace bulging or bending under the heat, iron supports with cylindrical bases are fixed on the inner sides of the supporting or running rings, against the inner flange faces of which the furnace rests.—H. H. B. S.

X.—METALLURGY.

Waste-Gas Condensers for Iron-Ore Kilns. H. Wedding. Verhandl. des Vereins zur Beförderung des Gewerbfleisses, May 1899, 185. Proc. Inst. Civil Eng. 1899, **137**, [3], 51—52.

A description is given of the waste-gas condensers used at Kolterbach, in Upper Hungary, when working with a mercurial tetrahedrite, which forms the "veinstuff" of the deposit of spathic iron ore. The raw ore has the following composition: "FeO, 43·24; Fe_2O_3, 0·60; MnO, 2·01; BaO, 0·47; CaO, 0·30; MgO, 5·07; Cu, 0·41; Sb, 0·06; Hg, 0·05; S, 0·78; CO_2, 30·39 per cent."

The plant consists of 36 conical kilns, holding 56—62 tons of ore each, fitted with hinged covers, which can be lifted for charging, and have a central pipe for taking off the gases, with an automatic stop-valve that closes the pipe when the cover is open. The pipes from the kilns are connected with a main gas-conduit leading to the condensing towers, wooden structures with grids carrying pieces of limestone, which are kept wet by a constant shower of water. One tower is provided for each group of 12 kilns. The gas is drawn off by a Körting steam-injector in the main pipe, worked with steam at a pressure of five atmospheres, which exhausts about 3,600 cb. ft. per minute, at 4 ins. water-gauge, and delivers the mixture of steam and gas to the towers at the same pressure. Three different products containing mercury are obtained from different parts of the arrangement, namely, flue-dust from the front of the injector, and two kinds of slimes from the condensing water of the towers; the slimes are collected by allowing the deposit to settle very slowly in a series of clarifying ponds. The flue-dust contains 78·1 per cent. of mercury, whilst the slimes contain from 49 to 76 per cent. The kiln gas contains about 1·3 grains of sulphur dioxide per cubic foot; one half of this is removed in the first condensing tower, whilst in the second, the amount is reduced to 0·02 grain. The mercurial dust and slimes collected from the condensers, together with argentiferous copper ores picked out by hand (containing 1·85 per cent. of Hg), and mercury ore obtained by washing and dressing (containing about 0·5 per cent. of Hg), are heated in order to obtain mercury, in a Czermak roasting furnace with a stoneware pipe condenser. In 1898, about 400 tons of these materials were heated, and produced 12,000 lb. of mercury, the loss in roasting being about 20 per cent.—A. S.

Refractory Metallic Oxides, Reduction by Aluminium of. F. Kuppelwieser. Oesterr. Zeits. Berg- und Hüttenwesen, 1899, 147; Proc. Inst. Civil Eng. 1899, **137**, [3], 53.

The author gives, in the following table, the results of theoretical calculations as to the possibility, upon thermochemical grounds, of the application of the Goldschmidt method of reducing metallic oxides with finely divided aluminium (this Journal, 1898, 543, 584, and 649):—

		For the Production of 1 kilo. of					
		Iron.	Manganese.		Silicon.	Chromium.	Tungsten.
Oxide employed		Fe_2O_3	MnO_2	Mn_3O_4	SiO_2	CrO_3	WO_3
Aluminium required	Kilo.	0·484	0·656	0·492	1·272	0·520	0·294
Heat developed	Calories	3,456	4,684	3,512	9,082	3,713	2,099
Heat absorbed in reduction	,,	1,796	2,115	2,000	7,830	2,200	1,100
Heat of fusion of slag	,,	548	742	550	1,439	582	324
,, ,, metal	,,	362	535	535	435	434	360
Total heat absorption	,,	2,706	3,392	3,091	9,704	3,216	1,784
Difference or heat available for radiation and other losses.	,,	750	1,299	421	− 622	497	315

It thus appears that the process is feasible in all the cases given except that of silica, where there is a deficiency of 622 calories. In the experiments, the iron and slag obtained were perfectly fluid and sufficiently hot to melt the immersed end of a 10 mm. iron bar in two minutes. The metal, however, proved to be "red-short" when hammered, probably from contained oxygen. In the first experiment with manganese, pyrolusite was used, and in the second, braunite; in both instances the resulting metal was well melted. The melting point of manganese, according to Van der Weyde, is 1,900° C.; that of chromium is said by Deville to be above that of platinum, and for purposes of calculation it was assumed to be 2,200° C. The thermal data in regard to tungsten are uncertain, and the margin of 315 calories is probably too small, as the reduction of tungstic acid was effected without any difficulty.—A. S.

Iron Ore, Use of Finely Divided. J. Wiborgh.
Iron and Steel Inst., Aug. 1899.

Finely divided iron ores are now largely produced by mechanical and magnetic concentration processes, and are utilised in various ways:—

1. By direct addition to blast-furnace charges.

In general only small additions are permissible, as otherwise the furnace operations are seriously interfered with (*a*) by the ore "sifting" through the fuel in an imperfectly reduced condition; this is lessened by the use of fuel in smaller pieces than usual: (*b*) by the adhesion of the partially reduced ore particles to the furnace wall, leading to "scaffolding;" this is lessened in some degree by making the boshes steep. At Vidlitz, a furnace with a bosh angle of 75° worked satisfactorily, even on concentrates alone, as long as cold blast was used, but there was serious scaffolding when the blast was heated. With a bosh angle of 83° to 85°, the author has found that as much as 50 per cent. of fine ore may be used in some cases. The scaffolding difficulty is generally greater when a hot blast is used.

2. Direct agglomeration before smelting has been found advantageous. It may be effected (*a*) by heat alone; (*b*) by the addition of fusible silicates and subsequent heating; (*c*) by briquetting with an addition of lime or (*d*) of carbonaceous material, which is subsequently coked.

3. Fine ores may be advantageously used in open-hearth furnaces to the extent of from 10 to 15 per cent. either

added direct to the charge of pig-iron or previously incorporated with it at the moment of casting.

4. The fine ore, when fairly rich, may be directly reduced to spongy iron capable of replacing scrap in the open-hearth furnace in an open-hearth furnace of peculiar construction.
—J. H. C.

Iron, Diffusion of Elements [S.P. &c.] in. J. O. Arnold and A. M'William. Iron and Steel Inst., Spring Meeting, 1899.

After referring to Campbell's experiments (this Journal, 1897, 801) showing that sulphur, when in combination as an oxysulphide, diffused through heated iron, and to the fact that phosphorus as a compound will also diffuse through iron, the authors attack the problem as to whether carbon diffuses in the free state or as a carbide. From a series of experiments in which cores containing different percentages of carbon were closely fitted and heated in jackets of iron containing 0·05 per cent. of carbon, and analyses afterwards made of concentric layers of both cores and jackets, they found little of importance beyond the fact that the higher the carbon in the core, the more rapid the diffusion, although no simple mathematical relation appeared to exist between them.

Experiments were next made with cores constant in carbon, 1·78 per cent., and with jackets varying in carbon and heated *in vacuo* for six hours to different temperatures, the amount of diffusion being compared by analyses of portions of the jackets, $\frac{1}{25}$th of an inch adjacent to the core. The results seem to negative the simple solution theory, and to prove that at any rate normal carbide, Fe_3C, is capable of diffusing as an unaltered compound. Whilst the diffusion takes place in jackets containing 0·05 and 0·59 per cent. of carbon when the free path for the necessary interpenetration is opened by the metal being heated to just above the well-known change point, Ar_2, coincident with the evolution of gas from the metal *in vacuo*, it does not take place with a jacket containing 0·89 per cent. of carbon, or supersaturated with $Fe_{24}C$, until a temperature of at least 900° C. has been reached. Thus the free path in this case appears to open at about 150° C. higher in temperature, and this gap, of which there is no corresponding example in the known data of the physics of saline solutions, points to the probable diffusion of two definite carbides of iron. Details of the micrographic analysis of polished and etched cross sections of these cores and jackets, with plates showing the distribution of the carbides, are given; and the authors, to remove existing confusion, have written a short key, explaining the words ferrite, pearlite, cementite, graphite, and martensite.

In a consideration of the "carbon solution" and "carbide diffusion" theories, it is pointed out that the former assumes that at 700° C. the carbon and iron of the normal carbide, Fe_3C, dissociate and form a simple solution of carbon in the mass, and that on cooling to Ar_1 at 680° C. they combine again to form the carbide. In its application to steel containing 0·3 per cent. of carbon, the carbon will be in simple solution at 1,000° C. in the iron, which, on cooling to about 700° C., separates itself into two-thirds ferrite (iron) and one-third pearlite (a definite mixture of $21\ Fe + Fe_3C$), previous to which the areas of the latter particles had segregated, forming martensite ($Fe_{24}C$). So that apparently the dissolved free carbon had abandoned two-thirds of the iron solvent, and concentrated itself into the remaining one-third, to form a concentrated solution therewith. This appears to be antagonistic to simple solution, since there should be no valid reason why the dissolved carbon should not remain *in situ* as the metal cools and the Fe_3C become evenly distributed throughout the mass.

On the other hand, now that it has been proved that a compound can diffuse through red-hot iron, the last objection to the subcarbide theory seems to have been removed. In the application of this theory to the same 0·3 per cent. carbon steel, the pearlite areas become subcarbide (martensite) on heating to about 700° C., or Ar_1 change point, and remain as such until the temperature reaches 750° C. and the mass of iron passes the Ar_2 change point, when the ferrite and martensite molecules begin to interpenetrate, until density equilibrium is established at about 900° C. On cooling, these changes are reversed, and if the mass is maintained under the influence of slow cooling after the temperature has fallen to the point Ar_1, or about 680° C.—that is to say, after the ferrite and martensite have become established in their separate areas at 750° C., and after the martensite has further decomposed into pearlite—the normal carbide, Fe_3C, in the pearlite and the iron molecules undergo a distinct segregation very similar to that taking place just previously in the molecules of the ferrite and martensite. The authors welcome the analogy of the freezing brine solution, which, whilst not altogether applicable to the carbon solution theory, exactly compares with and supports the subcarbide theory. Thus, in brine solutions there exists a definite hydrate of sodium chloride and water not in combination, which on freezing segregate, forming ice and a solid cryohydrate, the latter then decomposing into a "eutectic," *i.e.*, alternating particles of salt and ice. In hot unsaturated steel there exist a definite subcarbide and free iron, which on cooling segregate, forming a "cryocarbide" which decomposes into the "eutectic" pearlite, consisting of alternating particles of Fe_3C and Fe.—A. W.

Carburised Iron, Solution Theory of. A. Stansfield. Iron and Steel Inst., Autumn Meeting, 1899.

The freezing point curve of iron containing carbon shows a minimum point about 1,130° C., for a carbon-content of 4·3 per cent. From molten metal containing more carbon than this, carbon separates out on cooling: from that containing less carbon, iron or a solid solution of carbon in iron containing less carbon than the original metal; the tendency being to produce the eutectic containing 4·3 per cent. When this solidifies, graphite separates out if the carbon present be above 1·2, but not if it be below 1·2 per cent.; so that at 1,130° C., iron can hold 1·2 per cent. of carbon in solid solution. At 1,000° C., however, or thereabouts, iron can hold more than this amount of carbon in solid solution. From these facts, and from calculations based on the application of Heycock and Neville's formula to the freezing point curve, the author concludes that the carbon in the molten metal is in simple solution, and probably in monatomic molecules; that the carbon in the solidified iron is also in simple solid solution, of unknown molecular weight; and that on cooling below the freezing point, this carbon combines with the iron to form a carbide, probably $(Fe_3C)_2$. At temperatures below 1,000° C. this carbide separates as cementite, probably polymerising in so doing, and at the same time any graphite present gradually dissolves and also forms cementite. The presence of this cementite influences the temperatures at which the allotropic changes take place during the cooling of iron. In steels containing less than 0·34 per cent. of carbon, the change from γ- to β-iron begins at a temperature somewhere below 895° C. (the Ar_3 point for pure iron); the β-iron formed, containing no cementite, undergoes the change to α-iron at 765° C. (the Ar_2 point), while the cementite concentrates in the γ-iron, till at 690° C. it is saturated, and the cementite and iron (now in the α form) separate out together as pearlite. In steels containing 0·34 per cent. of carbon, the Ar_3 and Ar_2 points coincide; the excess of iron separates at once in the α form, and the residual solid solution is decomposed, as before, at the Ar_1 point, 690° C. When there is as much as 0·8 or 0·9 per cent. of carbon in the steel, its composition is the same as that of the solid eutectic, and the solid solution cools down as a whole, till at 690° C. it is completely converted into pearlite; while with still higher carbon-content, cementite separates during the cooling, and at 690° C. we have a mixture of pearlite and cementite. The solution theory is sometimes spoken of as antagonistic to the allotropic theory of the differences amongst irons and steels; in reality the two theories are mutually helpful, and neither alone is sufficient.—J. T. D.

Constitution of Steel. E. W. Campbell. Iron and Steel Inst., Autumn Meeting, 1899.

Arnold's experiments have shown that phosphides, in true solid solution in iron, really diffuse through it; but the author still regards the penetration of iron sulphide or oxysulphide through iron as a process of filtration. But the fact that a compound can diffuse through iron takes away the force of the argument that the diffusion of carbon through iron shows the carbon to be present in the elemental form. There seems no reason why carbon, present in the iron entirely as "ferrocarbons," should not migrate from high-carbon to low-carbon iron by a process of ionisation. The author thinks that the changes produced by hardening and tempering may probably be all explained by polymerisation (or the reverse) of these "ferrocarbons" (see this Journal, 1897, 145), and their solution, either with or without "iron of crystallisation," in the excess of metallic iron.—J. T. D.

Damask Steel. Anossoff. Eng. and Mining J. 1899, **68**, [9], 250.

It is stated that damask steel may be produced in four ways:—(1.) Iron ore is treated with graphite. (2.) Iron is melted with charcoal and the carbon partially reduced by iron scales. (3.) Iron previously carburised is subjected to a prolonged reheating in an air-tight vessel. (4.) Iron is directly melted with graphite. The last method is considered to be the best and least expensive.

12 lb. of iron (8 lb. if the damask surface must be very hard) are covered in a crucible with a mixture of graphite, iron scales, and flux, in the following proportions:—Pure iron, 12 lb.; graphite, 1 lb.; iron scales, $\frac{1}{3}$ lb.; and dolomite, $\frac{1}{3}$ lb. The crucible is covered and placed in a charcoal furnace with a blast pressure of 20—25 mm. After 3 or $3\frac{1}{2}$ hours, the metal is entirely melted and covered with a thin layer of slag, on the surface of which floats the excess of graphite. The loss of graphite amounts then to $\frac{1}{4}$ lb. If the fusion lasts four hours, as much as 0·4 lb. of graphite is lost, and the metal assumes a wavy, watered appearance; whilst if the operation be continued $4\frac{1}{2}$ hours, the loss of graphite may reach $\frac{1}{2}$ lb., and the "moiré" effects are of medium size. If the crucible begins to "lean," the operation should be discontinued. If the inclination of the crucible, however, be slight, the operation may be continued, the metal assuming then a more or less pronounced "moiré," recticular in character, and sometimes "chevroned." After the fusion be ended, the blast is stopped and the crucible is allowed to cool in the furnace; it is then uncovered, the excess of graphite removed, the slag broken, and the metallic mass taken out. The metal must be forged with great care and at a relatively low temperature; if the steel be heated to a white heat, it loses some of its malleability, and if it be hard it crumbles away, whilst if it be soft it loses its "moiré."—A. S.

Expansion of Iron at High Temperatures. H. le Chatelier. Comptes Rend. **129**, [6], 331—333.

At temperatures below the point of transformation, pure iron and steel of varying carbon content (0·2 to 1·21 per cent.) have sensibly the same coefficient of expansion, which increases as the temperature rises, from 0·000011 at the ordinary temperature to 0·000017 at 750° C. This is what we should expect, if steels at these temperatures are to be regarded as a matrix of pure iron through which are disseminated crystals of the carbide Fe_3C.

At temperatures above the point of molecular transformation, however, the coefficients of expansion of different steels are different, and increase with the percentage of carbon; the significant figures of the coefficients for iron and steels containing 0·05, 0·2, 0·8, and 1·2 per cent. of carbon are 15, 17, 22, 29, respectively. At these high temperatures we have to do in steels with true solid solutions of carbide of iron in iron, the expansion of which is quite unrelated to that of either constituent.

The author has not obtained any satisfactory figures for the contraction at the point of molecular transformation, and is still working at this. He suggests that the anomalous results he has obtained possibly arise from a dual phenomenon: the molecular transformation of the iron, accompanied by a contraction (on 100 mm.) of 0·26 mm., and the solution of the carbide in the transformed metal, accompanied by an expansion, the extent of which depends on the amount of carbide present.—J. T. D.

Iron and Steel, Changes of State of. H. le Chatelier. Comptes Rend. **129**, [5], 279—282.

The author has endeavoured to measure the dilatation of iron and steel in the neighbourhood of the point of recalescence, and of the temperatures of magnetic transformation. He finds that there is no sudden change of volume at the temperature of recalescence, but that as the temperature rises there occur successively two sets of changes of dimensions, of opposite sense, which, in the case of normal steel containing 0·9 per cent. of carbon, almost exactly neutralise each other. No change of dimensions could be measured during the magnetic transformation of steel; but it would appear from this, and from analogy with nickel, that this transformation is not sudden, but continuous over a very noticeable range of temperature, and occurs whether the metal be in a magnetic field or not. This is a unique example of a continuous change in a solid body. An examination of the "superior" transformation of iron showed that this takes place at widely varying temperatures, according to circumstances not easy to discover. The author concludes that the laws of polymorphism and of solution will not explain all that happens to iron; that it possesses peculiar properties which will need prolonged research for their elucidation. He suggests a double fusibility, similar to that of selenium, as possibly one of these properties.—J. T. D.

Mineral Wool, Manufacture of Sulphide-Free. A. D. Elbers. Eng. and Mining J. 1899, **68**, [9], 248.

The author describes U.S. Pat. 623,398, April 18, 1899, in which is claimed a method of manufacturing mineral wool free from sulphur by remelting blast-furnace slag in admixture with moderate quantities of gypsum or other sulphates of the alkaline earths. The reaction which takes place is as follows:—$3CaSO_4 + Ca(Mg, Fe)S = 3CaO + Ca(Mg, Fe)O + 4SO_2$. It is, however, necessary to use rather more than the theoretical quantity of gypsum, as part of the latter undergoes reduction when it comes in contact with the red hot fuel, and the resulting calcium sulphide requires to be reoxidised by a fresh portion of sulphate. It is stated that with an addition of 9 per cent. of dry gypsum rock ($CaSO_4.2H_2O$), a mineral wool was produced that contained only about 0·02 per cent. of sulphur.—A. S.

Slimes [Gold], Sampling, Analysing, and Treating. L. Ehrmann. J. Chem. and Metallurgical Soc. of South Africa, 1899, **2**, 117—121.

An automatic sampler for slimes is described, in which an ordinary driving wheel transmits motion to a flat disc, perpendicular to a hollow axle and parallel to the axle of the driving wheel. An incurved pipe passes from the hollow axle to the circumference of the disc, so that, at each revolution of the latter, "the lower part of the curved pipe plunges into the slimes from the top of the liquid to the bottom of the launder, then goes to the top again, and is filled with a portion of the liquid slimes," which sample is delivered into the hollow axle. This axle is extended, and inclined at the end so as to deliver each sample into a prism-shaped funnel having two pipes, one pipe leading back to the launder and the other to a tin box or bucket, where the sample for analysis is collected. A movable partition may be adjusted in the funnel so as to apportion the slimes for return to the launder or for collection in any desired proportion.

The author strongly advocates the use of milk of lime, of carefully adjusted composition, instead of powdered lime, in precipitating slimes. The milk of lime has a density of about 20° B., and contains from 20·6 to 22·4 per cent. of calcium oxide.

A series of experiments is described, made upon a quantity of well mixed and sieved old slimes, in which assays of different portions gave results varying from 6 dwt. per ton to 2 dwt. 14 grains. Part of the lot was then mixed with a quantity of water, and run through an apparatus formed alternately of amalgamated copper plates separated by an india-rubber isolating frame from iron plates. The plates were perforated at alternate ends for admission and circulation of the slimes, which run through the apparatus, the distance between the parallel plates being from $\frac{1}{4}$ in. to $\frac{3}{16}$ in. Tests showed that amalgamation, without any chemical treatment, recovered 13·2 per cent. of the gold in the slimes.

To prepare the slimes for assay, they are passed through a filter press, and from each dry cake obtained, two opposite triangular parts are cut; these portions are pulped with water and again passed through the press until only one cake is obtained. Triangular portions are cut from this, and are treated with aqua regia, to get final samples for assay. "For slimes after treatment, residue samples, containing dissolved gold, weigh first 100 grms. of the pulp and dry it, so as to get per cent. solution and per cent. residue slimes. Now send the full lot of the sample through the filter press, keep a sample of the clear solution for determination of dissolved gold, and prepare the cakes through the filter press as described, until the last one is obtained; then, through this cake, by the special pump of the washing apparatus, force a few bottles of water so as to remove all soluble gold, and treat the washed cake as previously described for undissolved gold."—E. S.

Gold Precipitation by Zinc Dust. G. A. Pacard. J. Chem. and Metallurgical Soc. of South Africa, 1899, **2**, 128—129.

In the United States, the method of precipitating gold from dilute cyanide solutions by zinc is still adhered to. In the case of one plant at Utah, 500 tons of ore a day are treated. The oxidised ores go direct to the tank after crushing, the clayer ores are roasted, and from the baser ores the arsenic, antimony, and sulphur are removed before cyaniding. The solution passes from the ten leaching tanks to three storage tanks, whence it is drawn into the three precipitating tanks, each 14 ft. in diameter and 8 ft. deep. Zinc dust is added, and the liquid is agitated by the admission of compressed air at the bottom of the tanks. After being pumped out through a filter press, the solution goes to the sump tanks to be used over again.

Practice differs in some works as to allowing the zinc dust to settle before drawing off. The strong solution used at the works specified, contained about 0·3 per cent. KCy, and the zinc consumption amounted to about one-fourth of a pound per ton of ore treated. The same method of precipitation is used at other works with cyanide solution containing only 0·05 per cent. KCy, and from 3 to 5 dwt. of gold per ton on going to the tanks; after precipitation, a maximum of 2 grains of gold may remain per ton. Solutions containing from 0·2 to 0·25 per cent. of KCy retain, after zinc precipitation, as much as 5 grains of gold per ton. In all the plants using this process, the bullion extraction fully equals the assay extraction.—E. S.

Platinum from Gold, Separation of. E. Priwoznik. Oesterr. Zeits. f. Berg- u. Hüttenw. 1899, **47**, 356.

Gold scrap containing platinum is kept apart for separate treatment in minting because the ordinary methods of refining gold would not be suitable for it. The author here describes the method used by him for dealing with a large batch of metal. The sifted filings were digested with nitric acid of sp. gr. 1·199 as long as any silver dissolved, a trifling amount of platinum also dissolving as silver platinonitrite. The metal remaining was then washed and digested with aqua regia (composed of 100 vols. of conc. HCl, 43 vols. of conc. HNO_3, 143 vols. of H_2O), until the silver chloride forming on the surface of the metal prevented further action. The solution of gold is then poured off and the silver chloride is removed by treatment with dilute ammonia, when the metal is again in a condition for further treatment with aqua regia. After six alternate treatments with aqua regia and ammonia the residual metal consisted of pure platinum. The acid solution containing the gold was evaporated with excess of hydrochloric acid to drive off nitric acid, until gold chloride crystallised out. This was then dissolved, and a small amount of platinum removed by adding ammonium chloride, and the gold was finally precipitated by ferrous sulphate. The filings contained 28·05 per cent. of gold, 10·56 per cent. of silver, 45·46 per cent. of platinum, and 15·93 per cent. of copper. If the metals are really alloyed it is necessary to fuse with three parts of lead, or, better, of zinc. After granulating the melt, it is easy to remove the zinc by treatment with sulphuric acid, and the noble metals remain in a finely divided form suitable for separation by the method already described.—G. H. B.

Lead Smelting in the Blast Furnace at Pertusola. Berg- und hüttenmännische Zeit. 1899, 189. Proc. Inst. Civil Eng. 1899, **137**, [3], 56.

Lead ores are smelted at Pertusola in a blast furnace 23 ft. high and 7·5 ft. diameter in the hearth, provided with 15 tuyères arranged in two series at different levels, whereby it is claimed that the sulphides in the charge are more completely oxidised; the working capacity of the furnace is increased, together with a diminished consumption of coke, and a higher temperature is attained in the melting zone, so that slags containing a large proportion of zinc can be rendered perfectly fluid. It is stated that under the most favourable conditions as much as 270·6 tons of ore and fuel have been passed through the furnace in 24 hours, but the average amount is 233·1 tons.

The yield of silver is $512\frac{2}{3}$ tons or $73\frac{1}{4}$ tons in 24 hours, or 39·95 per cent. on the charge; and 44 cwt. of coppery dross containing 30 per cent. of copper, 40·5 per cent. of lead, and 0·052 per cent. (17 oz. per ton) of silver. No regulus is produced, and the coke consumption is 8·04 per cent. of the weight of the materials smelted. The slag has the following composition:—SiO_2, 26·70; FeO, 32·95; ZnO, 12·88; CaO, 19·71; Al_2O_3, 3·10; MgO, 1·80; PbO, 1·16 (Ag, 0·009); S, 1·03 per cent.—A. S.

Cadmium in Zinc Ores. E. Jensch. Berg- und hüttenmännische Zeit. 1899, 14. Proc. Inst. Civil Eng. 1899, **137**, [3], 56.

The author gives the result of the examination of zinc ores from different localities as to the amount of cadmium they contain. In many metallurgical text-books it is stated that the zinc ores of Upper Silesia contain 2—5 per cent. of cadmium, but the author found that the ore raised at the present time contains only amounts varying from 0·004 to 0·306; average, 0·102 per cent. of cadmium. Blende from the Upper Harz, also reputed to be rich in cadmium, contains as a maximum 0·01 per cent., and is often completely free from that metal. In the ore from Saxon mines the range is 0·011—0·100 per cent., and in that from Styria, Carinthia, and Carniola, 0·003—0·140 per cent. The highest proportion of cadmium found was 0·46 per cent., in a sample taken from 208 tons of a black blende from Finland, but the blende of Matlock and Wanlockhead, and the transparent yellow variety from Cunillas, near Santander, also contain more than 0·40 per cent. In the Norwegian and Swedish blendes the proportion varies from 0·047 to 0·40 per cent., the poorest kinds being those from Northern Norway and Lapland, containing 0·008—0·010 per cent.

Cadmium is also found in coal, in which it probably exists in the iron pyrites also present. The highest proportion found was 0·008 per cent. in rough slack, reduced to 0·001 per cent. in the washed coal. A large portion of the cadmium contained in zinc ore is lost during calcination, the average of 0·110 per cent. in raw Silesian blende being reduced to 0·042 per cent. after roasting. The cadmium is condensed to a great extent in the flue dust, which contains 0·22—2·02 per cent.—A. S.

River Water, Pollution of, by Cyanide. Eng. and Mining J. 1899, **68**, [9], 251.

See under XVIII. B., *page* 939.

Sulphur in Pig-Iron, Steel, &c., Volumetric Estimation of, by means of Arsenious Acid. J. Thill. Zeits. anal. Chem. 1899, **38**, [6], 342.

See under XXIII., *page* 947.

Crude Silicon, Analysis of. H. Bornträger. Zeits. anal. Chem. 1899, **38**, [6], 350.

See under XXIII., *page* 946.

PATENTS.

Blast-Furnace, Top-Gases of; Apparatus for Precipitating out of the Clear Water the Solid Particles of the. G. Zschocke, Kaiserslautern, Germany. Eng. Pat. 17,204, Aug. 10, 1898.

The solid particles separated from the gases by the washing water are collected in the form of solid or pasty masses by means of permanent filters, the filtered water being available for re-use. The apparatus is arranged so that it can be cleaned whilst in operation.—R. A.

Sheet Iron, Manufacture of. J. Stephens, Muncie, U.S.A. Eng. Pat. 17,704, Aug. 17, 1898.

Planished sheet iron, uniform in colour and polish, is prepared by rolling the sheets in packs, without any of the usual coatings for preventing cohesion, separating and changing the sheets in the pack so as to present different surfaces to one another, reheating the pack to a low temperature, again changing the sheets and rerolling. In addition to this treatment, the sheets may be subjected to a hot solution of "verdigris" and paraffin wax, afterwards exposed to the air to dry, subjected when dry to a hot solution of indigo and paraffin wax, and finally polished after removing the surplus solution by passing through rolls suitably protected against the action of the hot mixture.—A. W.

Metals [Precious Metals] from their Ores, Method for the Extraction of. E. Bohon, Cureghem, Belgium. Eng. Pat. 18,032, Aug. 22, 1898.

The ore is submitted simultaneously to amalgamation and cyaniding, after the precious metals have been set free by a convenient treatment, the said amalgamation being accelerated by the addition of suitable substances, such as salt or lime. The cyanide dissolves the fine gold, &c., and the mercury precipitates and amalgamates with it. In addition, the amalgam may be heated with nitric acid, which leaves the gold and platinum as a residue and dissolves the mercury and silver, the last-named being afterwards recovered by precipitation.—A. W.

Metal Leaf, Manufacture of. S. Pitt, Sutton. From The Pharmaceutisches Institut Ludwig Wilhelm Gans, Frankfort-on-Main, Germany. Eng. Pat. 21,306, Oct. 10, 1898.

In the preparation of the thin leaf of various metals and alloys for ceramic work, a plate, such as porcelain, capable of resisting heat and acids, is first covered with a ceramic lustre of an ordinary or non-precious metal, and fired to produce a soluble surface or bed, upon which a ceramic lustre preparation of the desired metal is then placed and fired, the whole being afterwards dipped in acid, which dissolves the bed, but not the porcelain or metal, so that the thin sheet or skin of metal can be peeled off. In the case of a brittle metal, such as osmium, a coating of tough varnish or collodion is placed over the metal previous to dissolving the bed, so that the film is afterwards peeled off adhering to the varnish, which latter can then be dissolved or burnt off.

For gold, silver, iridium, and rhodium sheets, a piece of porcelain, a magnesia lustre for the bed, an ordinary ceramic metallic preparation, and dilute sulphuric acid are employed; whilst for osmium sheets, a piece of platinum, a thorium oxide lustre for the bed, an osmium ceramic preparation, a gutta-percha solution, and hydrochloric acid are used.—A. W.

Silver Plating, Improved Process for. R. Fiedler, Berlin, Germany. Eng. Pat. 14,324, July 11, 1899.

In a previous patent (this Journal, 1899, 843) for cold-silvering metal surfaces, the mixture contains both ammonia and cyanide of potassium. These are now dispensed with, and the following mixture is claimed for application for rubbing on the cold metal:—15 grms. of silver nitrate, converted into chloride by hydrochloric acid, mixed with 350 to 400 grms. of tripoli powder or jeweller's rouge or fine emery, with 80 to 100 grms. of acetic acid or vinegar, and with 300 to 350 grms. of cooking salt or saltpetre, and diluted with 1 litre of water.—A. W.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Saturation of Solutions from Measurements of the Electrical Conductivity, Estimation of the. H. M. Dawson and P. Williams. Zeits. für Elektrochem. **6**, [9], 141—144.

The authors describe a special apparatus for determining the electrical conductivity of saturated solutions at different temperatures. When the specific conductivity of saturated solutions of Glauber's salt at different temperatures is plotted against the temperature, two distinct curves are obtained, and their point of intersection gives the temperature at which the hydrated salt passes over into the anhydrous state. This was found to be 32·55° C. Similarly, in the case of thallium sulphate, a point is obtained which represents the temperature at which $Tl(SO_4)_2 . 9H_2O$, passes over into $Tl(SO_4)_2 . 4H_2O$.—J. S.

PATENTS.

Alkaline Salts, Electrolytic Decomposition of. E. Edser, Putney. Eng. Pat. 18,958, Sept. 5, 1898.

In an electrolytic cell there is a partition composed of a series of troughs so shaped and disposed as to contain a quantity of mercury which seals the interstices between the troughs, of V or ഗ or similar section, and so prevents the mixture of the liquids contained in the compartments separated by such partition, while permitting, by means of the mercury, through electric communication between the compartments. In action—*e.g.*, electrolysing a solution of sodium chloride—an amalgam is formed upon one side of the partition [they are shown arranged both vertically and horizontally] by the deposit of the alkaline metal upon the mercury; while upon the other, caustic alkali is produced by the action of the diffused sodium in water.

The invention further consists in detailed features of construction and arrangement, described and illustrated. —J. C. R.

Gases and Gaseous Mixtures or Compounds, Electrolysis or Electrical Treatment of. R. J. Yarnold, London. Eng. Pat. 2629, Feb. 6, 1899.

"This invention relates to improvements in the electrolysis or electrical treatment or allotropic modification of gases and gaseous mixtures or compounds." An apparatus, of concentric form, is shown. The gas or gaseous mixture is caused to flow in thin layers between "a compilation of respectively insulated dielectrics"—glass or mica—"of different electric inductive capacity to that of the gas or gaseous mixture or compound under treatment." These are arranged or sandwiched between two outer or outside covering electrodes. The following are mentioned as examples of the materials treated: oxygen, hydrogen, chlorine, and atmospheric air; carbonic acid, hydrochloric acid, coal gas and hydrocarbon gases.—J. C. R.

Filling Paste or Active Material for the Plates of Secondary Batteries. C. F. P. Stendebach, Leipzig, and H. M. F. Reitz, Dobitz, near Taucha, Leipzig. Eng. Pat. 8963, April 28, 1899.

"The improved production of a filling paste or active material for secondary batteries, the distinguishing feature of which is that combinations of lead (minium, litharge) are mixed with combinations of lead containing little oxygen, but being rich in hydrogen, and consisting of a preparation of lead, produced by boiling metallic lead in diluted nitric acid, the removal of the metallic lead, and the introduction of zinc, coke, or carbon strips or sticks into the liquid, on which strips or sticks the lead is deposited, the residue of the nitric acid being eliminated therefrom by means of diluted sulphuric acid, and the said preparation of lead kept excluded from the air, until mixed, in order to avoid premature oxidation; further, that in mixing with oxides of lead, various stages of lead oxidation are formed, and metallic parts are also present after the formation, which increase the effect, for the purpose of obviating the internal resistance, so that an exchange of oxygen and hydrogen occurs without any disadvantageous strain of the electrodes." The idea appears to be to bring together a hydride and an oxide to get a reaction similar to that met with in metallurgical operations where a sulphide and an oxide of a metal are brought together, *e.g.*, copper.—J. C. R.

Primary Batteries. W. C. Callmann, New York, U.S.A. Eng. Pat. 11,300, July 11, 1899.

Relates to gravity type of zinc-copper batteries. The claims are:—1. "A primary battery in which the exciting material for the exciting solution is supported between the superposed electrodes and out of contact therewith to be acted on and decomposed by the electric current." 2. "A primary battery in which a supporting plate is placed on the top of the lower or negative electrode, and carries the exciting material for the exciting solution, said material being out of contact with the superposed electrodes and being acted upon and decomposed by the electric current."
—J. C. R.

(*B.*)—ELECTRO-METALLURGY.

Coating Metal Articles by Electro-Deposition, Apparatus for. J. Thornton and T. R. Canning, Birmingham. Eng. Pat. 21,233, Oct. 8, 1898.

"In apparatus for coating metal articles by electro-deposition, a drum, barrel, or the like, mounted in suitable bearings in an electrolytic tank, in such a manner that the said drum, barrel, or the like will be immersed in the electrolyte for less than half its diameter, a conducting bar projecting through the journal or journals of the said drum so as to be out of contact with the liquid in the tank and being in connection with metallic plates, strips, or rods within the tank, and with a brush or contact piece . . . . ."
—J. C. R.

XII.—FATS, OILS, AND SOAP.

Reindeer Tallow. W. S. Karasseff. Russian Physico-Chemical Society. Chem. Zeit. 1899, **23**, [64], 659.

Melted reindeer tallow resembles beef or mutton tallow, its melting point is 47°·8, and it yields 10·4 per cent. of glycerin, and 90 per cent. of fatty acids, which consist of 60·1 per cent. of stearic, 1·4 per cent. of palmitic, and 38·5 per cent. of oleic acid.—G. H. B.

Italian Beeswax. A. Funaro. L'Orosi, **22**, 109—123; Chem. Centr. 1899, **2**, [7], 404.

For pure Italian beeswax, the author gives the following constants, which agree well with those given by Camilla (Contrib. allo studio della cera gialla ital. 1891), sp. gr., 0·961—0·964; m.p., 63°—64°·4 C.; acid number, 21—22; saponification number, 91—96; index of refraction, 42°—45°—A. S.

Hazel-Nut Oil. J. Hanus. Zeits. f. Untersuch. Nahr. u. Genussmittel, 1899, **2**, [8], 617—622.

This oil, as obtained by extraction with ether, is golden yellow, and has an agreeable taste and smell. Its specific gravity at 15° C. is 0·9169, and its other physical and chemical constants are:—Saponification value, 193·7; Hehner value, 95·6; Reichert value, 0·99; iodine value, 90·2; acetyl value, 3·2; saponification value of fatty acids, 200·6; iodine value of fatty acids, 90·6; saponification value of unsaturated fatty acids, 198·5; iodine value of unsaturated acids, 91·3; mean molecular weight of unsaturated acids, 282·0; Maumené test, 36°·2; glycerin, 10·41 per cent.

The most important test for its detection is the iodine value and especially that of the unsaturated acids. In the elaïdin test, a green semi-solid mass is obtained—a reaction which is serviceable for the detection of the oil in the presence of olive and almond oils, which have similar iodine values. The presence of a large amount of hazel nut oil may be recognised by its characteristic odour.

For the estimation of the phytosterin the author employed a combination of the methods of Bömer and Tortelli-Ruggieri. 20 grms. of the oil were saponified with 100 c.c. of 30 per cent. alcoholic potassium hydroxide, the alcohol partially evaporated, the soap dissolved in water, and the solution extracted first with 200 c.c. and then with 100 c.c. of ether. The ethereal extracts were shaken with water after the evaporation of part of the ether. The residue of crude phytosterin left on evaporating the ethereal solution amounted to 0·147 grm. It was purified by dissolving it in benzene, filtering, evaporating the filtrate to dryness and crystallising the residue from 5 c.c. of hot methylic alcohol. The forms of the crystals obtained, were the same as those described by Bomer (this Journal, 1898, 954, and 1899, 301), but the rectangular shapes predominated.

The liquid fatty acids amounted to 85 per cent. of the oil and consisted probably of oleic acid, since neither linoleic nor linolenic acids were detected by the oxidation or bromination methods. Arachidic acid was not found, but stearic acid was present in small quantity (about 1 per cent.). According to the author's analysis, hazel-nut oil has the following composition:—Oleic acid, 85; palmitic and stearic acids, 10; glycerin (calculated from the saponification value), 10·41; and phytosterin, 0·50 per cent.—C. A. M.

Ceresin and Paraffin, The Determination of the Dropping Point of. Finkener. Mittheilungen aus d. königl. Techn. Versuchsanstalt, 1899, **17**, [3], 100—103.

When a mixture is warmed, of chemically pure substances of different melting points, having no action upon one another beyond a certain amount of solvent action, the temperature remains almost constant about the melting point of the lower melting constituent whilst it is dissolving the higher one, and then it rapidly rises. As it is difficult in such cases to determine the melting point, the author considers that the best method of determining the temperature at which the substance changes its state of aggregation is to take its dropping point under constant conditions. He has therefore laid down the following directions for the determination of the dropping point of paraffin and ceresin by the Customs authorities:—

The dropping point is the temperature at which a drop of the substance under examination falls from the end of a glass rod 3 mm. in diameter when slowly warmed in a test-tube 250 mm. long by 30 mm. wide. The test-tube is immersed to four-fifths of its depth in water, the temperature of which is raised about 1° C. each minute. The thermometer is placed beside the glass rod in such a manner that its bulb is about the same distance (about 30 mm.) from the bottom of the tube.

The size of the drop is regulated by melting the substance on the water-bath and dipping the rod into it to a depth of 10 mm., so that the drop on solidification forms a hemisphere on the end of the rod. If necessary this dipping is repeated.

In conclusion, the author gives the results of a number of parallel determinations of the dropping point of a sample of ozokerite ceresin under slight variations of the conditions, such as having the test-tube 26 mm. instead of 30 mm. wide, different positions of the thermometer in the tube, and different depths to which the tube is immersed in water. These show only slight variations.

The mean results obtained when the rate of the rise of temperature was varied, were: 0°·5 C., dropping point 74°·9 C.; 1° C., 74°·9 C.; 1°·5 C., 74°·6 C.; and 2° C., dropping point 74°·3 C.—C. A. M.

Ceresin, New Method of Examining, used by the German Customs. D. Holde. Mittheilungen aus d. königl. Techn. Versuchsanstalt zu Berlin, 1899, **17**, [3], 103—108.

In the directions given to the Custom House officials for the determination of the dropping point (see preceding abstract), it is stated that if this constant be 66° C. or higher, they may conclude that the substance consists only of ceresin derived from ozokerite; whilst if it be lower than 66° C., the sample must be regarded as a mixture of ceresin and paraffin.

In criticising these directions, the author points out that mistakes may readily occur if too much reliance be placed on the dropping point as a test of purity. Thus, mixtures of paraffin and ceresin may be prepared with dropping points considerably higher than 66° C. Mixtures of pure ceresin and carnaüba wax may "drop" far above that temperature, and the presence of paraffin in the mixture has but little influence in counteracting the effect of the carnaüba wax. Then there are pure paraffins which melt far above 66° C., such as, for instance, some obtained from Boghead coal, which, in the author's experiments, did not melt below 80° C., and others, from Halle, which had dropping points of 65·7 and 66·4 C. respectively. Finally, it is possible to prepare from a low-grade crude ozokerite pure specimens of ceresin which themselves melt far below 66° C. The author illustrates all these points in a series of tabular results given in the paper.

As regards the method of determining the dropping point, he remarks that numerous precautions are necessary if concordant results are to be obtained, and these precautions he gives.—C. A. M.

Vegetable Oils, Welmans' Reaction for the Detection of. P. Soltsien. Zeits. öffentl. Chem. **5**, 229 ; Chem. Centr. 1899, **2**, [5], 321.

See under XXIII., *page* 947.

Glycerin, Determination of Moisture in. G. Benz. Zeits. anal. Chem. 1899, **38**, [7], 436.

See under XXIII., *page* 950.

Gossypol: A Phenolic Compound Present in Cotton Seeds. L. Marchlewski. J. Prakt. Chem. 1899, **60**, 84.

See under VI., *page* 912.

Free Phosphorus in Fats and Oils, Detection and Estimation of. E. Louise. Comptes Rend. 1899, **129**, [7], 394.

See under XXIII., *page* 950.

PATENTS.

Lubricant. F. Donati and F. Hornbostel, Florence, Italy. Eng. Pat. 19,294, Sept. 10, 1898.

The lubricant claimed, consists of a mixture of lard (1,000 parts by weight) ; yellow ceresin (50 parts) ; carbonate of soda (100 parts) ; "Martius' Yellow" (5 to 10 parts) ; and finely powdered, pure plumbago (1 to 2 parts). These ingredients are mixed together at a temperature of 120° C. and allowed to cool.—W. P. S.

Adhesion Fat for Driving Belts and the like. W. Hofschulte, Freren, Germany. Eng. Pat. 14,274, July 11, 1899.

The claim is for a fluid fat consisting of about 60 per cent. of half saponified "oleine" (oleic acid), about 15 per cent. of vaselin oil, about 5 per cent. of castor oil, and about 20 per cent. of resin. The constituents are heated together with constant stirring until intimately mixed.—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Paints for Iron. Engineer, 1899, **88**, [2272], 29.

Experiments have been made with the view of ascertaining which of the paints and pigments in every-day use are the best for painting ironwork, with special reference to the preservation of the metal from corrosion and rusting under conditions of great severity. The effect was also observed of the addition of filling materials, such as "barytes" and "Paris white" or "whiting," to the paints. Forty-nine different paints were tried, made up as ordinarily used, without special treatment in any way. The pigments and body substances were ground with the oil between rollers, in proportions to give a stiff paint, which was thinned to the proper consistency for painting with genuine well-boiled linseed oil, capable of drying in seven hours under ordinary conditions of temperature, &c. Several grades of each paint were made up, from the pure pigment and oil to the same with a heavy addition of some filling material, chiefly barytes. Tests were also made with barytes alone ground in oil; and with linseed oil alone.

For the tests, three sets of iron plates were painted, and, after drying, given a second coat, which was allowed to become dry and hard. One set of plates was then exposed to the weather, out of doors, for eleven months and then examined. The plates were all in fairly good condition, with the exception of that one which had been painted with linseed oil alone, which was much corroded. The two other sets were treated in the following manner, the results of one set being taken to corroborate those of the other. The results, however, were practically identical in each case. Each painted plate was placed in a clean glass bottle with a wide mouth, and half-filled with clean, pure water. The bottles were left open and were allowed to stand for three months side by side on a shelf in the laboratory immediately under the table, so that whilst there was free access of air to the painted plates, the dust was kept out. At the end of the three months, the plates were removed from the bottles, and the amount of iron present in the sediment and liquid determined. The result was taken as showing the amount of corrosion; but it is actually lower than the real amount, as no account was taken of the rust adhering to the iron plate. The weight of rust was calculated to pounds per 1,500 square feet of painted surface. The detailed results are set forth in two long columns.

It was found that there was no rusting at all with the red lead paint, whether used pure or reduced by the addition of three times its weight of barytes. Orange lead, "vermilionette," and "permanent red" paints were equally good; the two latter are lead pigments, brightened by precipitated aniline colouring matters. Zinc white paints come next to the lead paints, giving only traces of rust, and then follow the white lead paints with from 75 to 95 lb. per 1,500 sq. ft. Pale iron oxide paint was nearly as good as the white lead; "deep oxide" gave 123 lb.; middle oxide, 134 lb., and bright oxide, 137 lb. of rust. Plain barytes paint was almost as good as the iron oxide paints, giving 155 lb. of rust. Pure graphite paint gave 215 lb. of rust. The blue and black paints were not so satisfactory.

It is thus seen that for iron surfaces partly immersed in water, red lead and orange lead are greatly superior to the other common pigments. The good result obtained with the paint composed of barytes and oil shows that this material is not so much of an adulterant as has been supposed. Its addition to some pigments of low efficiency is, indeed, a distinct improvement, but is not to be recommended in the case of pigments of high protective value, such as red lead, zinc white, and white lead.

As the colour of red lead is very harsh, it is suggested that the first coat might be of red lead, to be followed with one of the iron oxide paints, which form a good tough film when dry, and would protect the first coat from abrasions.

The results of further experiments with the same paints by painting iron trays, filling them with water, and allowing the latter to evaporate, confirmed those given above.

—A. S.

PATENTS.

Soot, Lamp-Black, and the like, of any required Specific Gravity, Process and Apparatus for the Manufacture of. G. Wegelin, Roudorf, Germany. Eng. Pat. 10,342, July 16, 1899.

In a former patent (Eng. Pat. 12,184 of 1898; this Journal, 1898, 747) it was shown that the specific weight of the product may be varied within certain limits, by the alteration of the transverse area of the flame, effected through a peculiar manner of admitting the air. To obtain considerable variations of the specific gravity of the product, it is now proposed to deprive the conical flame of combustion, which is of a high temperature, of a part of its great heat "in immediate proximity to the throttling point of the transverse area of the flame," the heat thus taken away being utilised by arranging a water reservoir or the like above the cone of the flame for the production of steam.—D. B.

Chromatic Shade Finder and Index for Use in Colour Blending. G. K. Henderson, Coshocton, Ohio, U.S.A. Eng. Pat. 9256, May 2, 1899.

See under VI., *page* 912.

(*B.*)—RESINS, VARNISHES.

Rosin (Colophony), Determination of the Constants of. R. Henriques. Chem. Rev. Fett- u. Harz-Ind. **6**, [5], 94—95; [6], 106—111.

With reference to the vexed question of the "ether value" as an indication of the quality of resins destitute of esters, the author expresses the opinion that—though their existence has not as yet been directly proved—compounds resembling lactones are present in colophony, and that the "ether value" is calculated to afford a measure of their presence.

From a later investigation he finds that colophony is free from esters and contains no large proportion of anhydrides, but only unsaponifiable constituents and free resin acids, the latter being separable, by means of petroleum spirit, into soluble normal acids and insoluble acids resembling lactone acids. The soluble acids give an "acid value" only, whilst the insoluble acids furnish in addition, a very high constant "ether" or "saponification" value.—C. S.

PATENTS.

Siccative Oils and Varnishes. C. Weygang, Gravesend. Eng. Pat. 17,478, Aug. 13, 1898.

Siccative oils, prepared according to Eng. Pat. 3025 and 23,995, 1894, this Journal 1895, 493 and 503 (*i.e.*, resin and petroleum mixtures, treated with an alkali), are mixed with linseed or cotton-seed oil, the mixture is thickened by agitation in the air or by blowing, and the final product is thinned with one of the usual solvents.—S. K.

Varnish, Manufacture of. A. P. Bjerregaard, Brooklyn, U.S.A. Eng. Pat. 15,310, July 25, 1899.

Instead of melting the gum first and adding the oil afterwards, the patentee mixes the two materials, applies heat to the mixture until the gum is melted in the oil, and then increases the temperature until the mixture exhibits the nature of a varnish. Preferably, raw linseed oil is used. By this method any unpicked gum (in lumps or in powder) may be used.—S. K.

Lacquers, Varnishes, Oil Colours, and other Substances liable to form a Skin or Film on the top, Stirring Device to overcome the Formation of Skins or Films in the Storing or Keeping of. H. W. N. Ahrens, Elmshorn, Germany. Eng. Pat. 15,847, Aug. 2, 1899.

A mechanical stirrer is used to prevent the formation of a skin, or, should a skin be present, to mix it well up with the liquid portion of the material.—S. K.

(*C.*)—INDIA-RUBBER, &c.

Rubber in Guatemala. Foreign Office Annual Series, No. 2354, Aug. 1899.

A pamphlet on "Rubber in Guatemala," written by Señor Horta, at the instigation of the Minister for Public Works, has recently been issued. The rubber tree, which grows wild in Guatemala and throughout Central America, is known as the *Castilloa elastica Cero* (an Artocarpus). The rubber this tree produces is said to be of the best known quality. The tree is tall, with smooth greenish-white bark. The branches, which are almost horizontal, spring from the tree at a considerable height from the ground, and from them hang two rows of long oval-shaped leaves. Each tree has but few branches; its flowers are white, and the fruit consists of nuts, contained in a pod. The milk is contained principally in the fibres between the cambium and the bark. This fibrous part is the vital organ of the tree. For this reason the tapping must be carried out with great caution. The milk contains about 60 per cent. of water, the remaining 40 per cent. represents the saleable product, of which again about 33 per cent. is said to be rubber of superior quality. Until a few years ago all the rubber was obtained from wild trees, but the increased demand and unsystematic destruction of trees has now driven the price of good-quality rubber to a high figure. The best climate for the growth of this tree is *tierra caliente*, or hot coast lands, at an altitude not exceeding 1,500 ft. The trees should not be planted in the sun, opinions to the contrary notwithstanding. The wild tree always seeks the shade of trees of greater growth, and by the help of these the sap remains in the normal state. The leaves are not of such a nature as to oppose the evaporation of the sap, so that without shade the production of milk suffers and the tree dries up. The tree requires not only a humid atmosphere, but also air and ample breathing room. A heavy undergrowth injures it and retards its development. High and well-distributed shade, without undergrowth, and good ventilation, produce healthy trees of rapid growth, long life, and abundant yield. Serious losses have resulted on rubber plantations placed in the open, not only in Guatemala, but also in Tabasco, Chiapas (Mexico), and in British Honduras. Planting the tree as a shelter for coffee or cacao has given very unsatisfactory results. In some cases the trees had to be replaced by others giving better shade; in other cases the plantation had to be abandoned. It is a mistake to plant together such plants as coffee and rubber, which require distinct climatic conditions, soil, and atmosphere; the result invariably is that neither acquires a proper development. Planting in the shade is, in a country like Guatemala, which possesses so much virgin forest, equivalent to planting in the woods, and there is unlimited space. It would be sufficient to cut part of the forest and lop the lower branches in order to obtain the requisite shade and ventilation of the ground. The planting of rubber trees from nurseries is to be preferred to planting by stakes or seeds. The nursery is formed in damp ground, shaded and well worked, and the seeds, gathered in March and April, should be planted about 1 ft. distant from one another. They should be planted just as gathered, with the gum. After a year's growth the trees are finally transplanted. The advantages of the nursery system are economy, better selection of healthy trees, lessened cost for replanting, more uniform growth. The rubber trees should be planted 8 to 10 yards apart. During each of the first two years after planting out, from three to four clearings should be made, removing the undergrowth which has sprung up, and spreading it over the ground to prevent the growth of weeds and to act as vegetable manure. False economy in this direction will injure the development of the trees. In the third and fourth years two or three annual clearings should be made, and from the fifth year one clearing per year will suffice. Before tapping the trees the latter should measure 12 ins. in diameter, and should be from 9 to 10 years old. Although the annual yield of rubber per tree has been stated as high as 3 lb., Señor Horta finds that 1 lb. is a good yield. The milk may be extracted twice each year—at the beginning of the rainy season, and towards its close. The incisions should be made with a knife such as is used in the East Indies; they should be made 1 or 1¼ yards apart, beginning above the lower portion of the trunk nearest the roots, until within 2 yards of the first branches. Each incision should consist of two symmetrical cuts, which together will reach two-thirds of the circumference of the tree, directing each in an opposite and upward direction from the point of union. The points of union of all incisions must be in a perpendicular line, in order that the milk from the highest incision may run to the lowest point of the next lower incision, and so on. Great care must be taken not to penetrate into the woody part of the tree. From the lowest point of the incision nearest to the ground the milk is conducted into a receptacle of clay or wood. The milk may be coagulated with an infusion of the vine "quiebra cajete," or with alum, or by evaporation, or by churning with water.

Señor Horta estimates the cost of planting 100,000 trees, after ten years, to amount to 95,000 dols. At the end of ten years this plantation, at the rate of 1 lb. of good rubber per tree, would yield 100,000 lb. (1,000 quintals) of rubber of the value of from 75,000 to 100,000 dols. gold, equal to 262,500 dols. Guatemala money. From this would have to be deducted the cost of production and collection of the rubber, cost of transportation, expenses of loading, and ocean freight, estimated in all at 72,550 dols. This would leave a net profit of 189,500 dols., equal to 100 per cent. on the capital invested.

The Government of Guatemala issued a presidential decree on January 14, 1899, promising for every 20,000 rubber plants of four years of age, and planted after the date of the said decree, a grant of one caballeria (112 acres) of uncultivated national land.—C. O. W.

India-Rubber Goods, Analytical Examination of. R. Henriques. Zeits. angew. Chem. 1899, [34], 802.

See under XXIII., *page* 950.

PATENTS.

Extracting India-Rubber or Gutta-Percha from Vegetables which contain them. J. G. Deiss, Salon, Bouches-du-Rhône, France. Eng. Pat. 12,538, Feb. 14, 1899.

At present india-rubber is extracted by a very crude process, consisting in tapping the trees and collecting the sap. When the same tree has been subjected to this operation a certain number of times, it becomes exhausted and dies. In order to extract all the rubber from the dead trees the bark is bruised and treated with an acid, preferably sulphuric acid, capable of decomposing the ligneous part without affecting the india-rubber or gutta-percha.—S. K.

Gutta-percha-like Substance, Manufacture of. A. Gentzsch, Vienna. Eng. Pat. 15,255, July 25, 1899.

Caoutchouc and wax of high melting point are kneaded together at a continuously rising temperature (up to 200° C.). An oil of a high melting point or one that becomes solid on heating may be added.—S. K.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Unhairing of Skins. F. Jean. Rev. de Chim. Ind. **10**, [116], 217—219.

The Pullman process is based upon the use of solutions of caustic soda and calcium chloride in place of the old lime pits. The prepared hides are placed in a 1 per cent. solution of caustic soda in a drum revolving 20 times per minute, the temperature being maintained at 35° C, and the machine being kept in motion for three hours. The skins are next taken from the tumbler and allowed to drain for some time, being then replaced in the tumbler with a ½ per cent. solution of calcium chloride, in which they are kept moving at the temperature of 35° C., for half an hour.

The unhairing is usually completed in five hours, whilst by the old lime-pit process it required from a fortnight to three weeks. The calcium chloride in penetrating the skins, swollen by the caustic soda, forms, by double decomposition, common salt and caustic lime, which are deposited in the interior of the skin, the advantage over the old method being that these detrimental salts are much more rapidly and completely removed by washing in warm water than the calcium carbonate formed under the old conditions.

J. G. Parker states that a soluble soap is formed, which is dissolved in the cleansing of the skins and thus greasy leathers are avoided. He estimates that by the Pullman process the heaviest hides may be unhaired in from eight to twelve hours, that the dissolving of part of the skin and consequent loss of weight is avoided, that a considerable saving of water is effected, and also the pollution of the streams is reduced to a minimum.

The author takes exception to Parker's statement that a soluble soap is formed by the Pullman process, and believes that by double decomposition an insoluble soap is formed in the calcium chloride bath. He considers that the process does not injure the hair, but leaves it in a condition suitable for the manufacture of felt and other similar fabrics.—A. M. F.

Chrome Tannage in Germany. Leather Trades Rev. **32**, [704], 913.

Though the advantages which chromed leather possesses over other kinds are generally known, the following shows where the application of chrome tannage produces leather of incontestable superiority to that produced by the old methods. For instance, *sheep skins* were formerly of comparatively little value, and used only as lining leather for boots and shoes. When chrome tanned, sheep skins produce an excellent, close-grained leather, worthy of comparison with goat skin obtainable by the old system.

In the case of *goat skins*, the effect of chrome tannage is remarkable, and its application to calf leather produces a leather which rivals kid, and has deprived the latter of its importance.

Ox Hides.—These, when split and chrome tanned, produce a leather equal to chrome calf.

Harness leather, when chromed, is more tough, resists the effect of the weather better, and can be more readily dyed.

Glove leather is improved by a chrome bath after having been tawed; and *furs* when chromed possess a hitherto unobtainable elasticity, and resist the weather much better than formerly.

On *machine belting* and *straps*, chrome tannage has effected the most important improvements of any that have been introduced during the last 50 years. Chrome-tanned belting has a greater tenacity than oak-tanned leather, and is capable of bearing a strain of from 400—900 kilos. per square centimetre. It is thus possible to use a much lighter belt, the weight on the pulleys is less, the friction is diminished, and power saved. Being a bad conductor of heat, it is useful in factories where danger of fire is great; it is unaffected by the weather, and for that reason is valuable for pumps, water pipes, &c., and, in fact, wherever a substance is required which is flexible yet tough, a bad conductor of heat, and capable of resisting external influences.

Chrome pickers are now ousting the old pickers, and it is claimed that in this branch the demand is at present considerably greater than the supply.—J. G. P.

Picker Bands, Oak-Bark Tanned. Leather Trades Rev. **32**, [704], 916.

In the manufacture of these goods English hides from 60 to 70 lb. in weight afford the best results. They are soaked and limed in rather an old lime liquor, and after the usual unhairing, fleshing, and cleansing processes, they are lightly bated, well cleansed from the bate, and are then tanned in a mellow tannage. They are usually in the "handlers" from five to six weeks, and then passed on to the "bloomers," afterwards passing on to a series of "layers," the process of tanning generally taking about six months. They are rounded after tanning, and the butts, after a good scouring on flesh and grain, are hung up to "sam." When stiff enough, they are set out, stuffed with sod oil in as large a quantity as possible, and hung up to dry. When dry, the excess of sod oil is slicked off, and the butts are then put into a stuffing drum with more sod oil; they are then drummed for two hours, the temperature of the drum being slightly raised. When taken out, the grease is again slicked off, the butts are dried, and are then laid away for two months in a vat of sod oil, after which they are finished in the usual manner, and cut up into picker bands.—J. G. P.

Acid-Tan Liquors, Estimation of Acid in. Drs. Paessler and Spanjer. Deutsche Gerb. Zeit. **32**, [76] and [77], June 27 and 29, 1899.

It is well known to every tanner that the firmness and substance of his leather depend upon the quantity of natural acids present in his tan liquors, and the tanner usually relies on the rule-of-thumb method of testing the acidity of his liquors by tasting them. Realising the importance of accurately regulating the quantity of acid present, Procter devised the method of estimating the amount of acid present by titrating the known quantity of filtered liquor with a saturated solution of lime water until a permanent cloudiness was obtained, expressing the same in terms of acetic or oxalic acid. This method was shown by Simand and Kohnstein to be inaccurate for liquors which contained a low percentage of tannin and a high percentage of acid, and they proposed heating the liquor with magnesium oxide in excess. The solution is then cooled and the undissolved magnesium oxide filtered. The dissolved lime in the filtrate is then removed, and the magnesia weighed as magnesium pyrophosphate. The amount of acid present can then be calculated as acetic acid. This method is, however, unsatisfactory, first, because of the tediousness of the process, and second, because the lime introduced into the hides from the lime pits always contains a certain amount of magnesia. Koch estimates the acidity in acid liquors by first precipitating the tannin with gelatin and then titrating the filtrate with a standard solution of baryta. But this process is also difficult to carry out satisfactorily, because no convenient indicator can be used to show when perfect neutralisation has been attained. Meerkatz attempted to show that Koch's method was inaccurate for all materials, with the exception of pine-bark liquors. The authors agree with Procter that this method can be made to yield perfectly satisfactory results, that the difficulties of observing the point of neutralisation can be overcome, and that sufficiently accurate results can be obtained for all practical purposes in the tanyard.

Good results are obtained by using small pieces of specially prepared litmus paper to detect the point of neutralisation. Probably the method is best carried out as follows:—25 c.c. of filtered liquor, together with 25 c.c. of gelatin solution (prepared with 2 grms. of gelatin dissolved in a litre of water and filtered), are well mixed and shaken together. A standard baryta water is now run in from the burette, stirred with a glass rod, and tested by means of litmus paper. As long as free acid still remains in the solution, the paper will remain red; as soon as all the acid contained in the liquor has combined with the baryta, the litmus paper will be turned blue. The acid can then be calculated in terms of acetic acid. Instead of baryta water, standard potash or soda may be used. The above is simply Koch's method, using specially prepared litmus paper in place of utilising the change of colour in the liquor as indicative of neutralisation. By this method the acid may be estimated within 0·01 per cent. As, however, it is never necessary to state the percentage of acid in tan liquors to the second decimal place in reporting to tanners, this method may be looked upon as a practically accurate one.—J. G. P.

Formaldehyde in the Tannery, Use of. W. Eitner. Der Gerber, **25,** [599] and [600], 205 and 218.

The hardening action of formalin upon animal tissue has been known for many years, and was first pointed out by Busch, in Strasburg, and was used in histological work as a hardening agent. The suggestion to use this material in the tanyard first took shape in 1891, in a patent which covered the addition of formalin to the tanning liquors as an antiseptic and a preventative of fermentation and decomposition, but it was shown later that it was unsuited for this purpose. Trillat communicated a paper to the Academy of Sciences in Paris on 30th May 1892, in which the following is quoted: "Formaldehyde has the characteristic of being absorbed by fresh hides, the fibres swell, and there appears to be a combination between the hide substance and formaldehyde similar to that which takes place in the formation of leather" (this Journal, 1892, 772). At the same time, Trillat pointed out that formaldehyde might find a use in the tannery.

The important characteristic which formalin possesses for the tanner is that it hardens the product. Although this hardening effect can be produced by some of the ordinary processes of tanning, it is much more easily obtained by the use of formalin. By its use the softest purely-tanned leather may be transformed into firm, sole leather.

Formalin can do either good or harm, according to whether it is used properly or otherwise. Two dry-weighed prepared hides were first softened in water and then treated with a 0·2 per cent. solution of formalin, which strength is suitable for the manufacture of sole leather. The pelt, treated with water alone, absorbed 197 per cent. of water; that treated with formalin absorbed 202 per cent. A great difference was noticed in two hides which had been prepared with lime and unhaired in the usual manner. In the one case the gain was 205 per cent., but, where formalin was used, 240 per cent. It shows, therefore, that formalin acts much more energetically upon pelt which has been prepared in an alkaline solution. The hardening action of formalin upon animal tissue undoubtedly depends upon a chemical reaction between formalin and hide substance. It is of a very complicated nature, and one which is difficult to explain. A raw hide which has been treated with formalin cannot be made into gelatin; the bundles of fibre are split up into fibrils just the same as by the action of such materials as salt, alcohol, or ether, but if these are afterwards treated with water, the fibrils soon contract and appear to join together again, forming bundles; but, after treatment with formalin, these fibrils remain detached and unaltered. For these reasons a chemical change can be considered to have taken place. Leather prepared by such means resembles to a certain extent "alum leather," but differs from that in the fact that it may be washed in either hot or cold water without altering its nature.

Sweated hides containing no alkali require more formalin to produce the firm, hard effect than limed hides, although when the latter are dried they will probably be softer than the former. Further, hides so treated will tan much quicker, but are usually light as to weight. The rapid tanning in the first case is really only rapid colouring, but where weight is required the goods need a period as long as without its use.

In the manufacture of sole leather, after the usual preparation, the hides should be coloured and swollen in the acid liquors. In the swollen condition they should then be put into the formalin bath. This previous tanning treatment prevents the hardening of the grain. It is not economical to add formalin to the liquors themselves, as the substances present there help to decompose the formalin, so that the goods should be put into an acid bath, having first been allowed to drip to free them from tan liquor. To this bath the requisite amount of formalin should have been added. A compound is sold under the name of "pralloformin," which consists of formalin and an acid, in such proportions that it may be used direct, using 1 part of this compound to 75 parts of water. The hides are put into this solution until they are sufficiently swollen, which may take from 6—24 hours. The goods then go direct into the colouring liquors, and are finished off in the usual manner. This pralloformin bath may be strengthened up and used over again for successive quantities of hides. This method is not, however, to be universally recommended, as what is suitable for one form of leather may not be suitable for another. A solution made according to the above recipe would contain 0·6 per cent. of formalin and 0·62 per cent. of an acid. It has been found that 0·02 per cent. of formalin is sufficient. As much as 0·62 per cent. would tend to make the grain too brittle and harsh.

The action of formalin has, naturally, been taken advantage of in the various drum tannages. Its action upon the grain allows of the hides being subjected to much stronger liquors than they would otherwise stand. Mixtures of formalin with oil dressing or with mineral tannages are possible, but can only be recommended for the production of mock kid. It is unsuitable for use in combination with chrome.

Many new products of formalin are now on the market: (1) "pralloformin"; (2) formatol = 11·5 per cent. of formalin and 7 per cent. of other substances, mostly glycerin and sugar; (3) "formoltan" contains 12 per cent. of formalin and 27 per cent. of other substances, mostly sugar and a little glycerin. As these added substances are of no use in tanning, they need not be considered. But it is better for the tanners to buy a formalin solution of guaranteed strength. The small quantity of formic acid or methyl alcohol, which commercial formalin contains, is not present in sufficient quantities to interfere with the results in tanning.—J. G. P.

Logwood, Improved Treatment of. The Textile Manufacturer, 1899, 196.

See under IV., *page* 907.

Tannin, Estimation of, and the Influence of Gallic Acids on the Process. A. Heinemann. Zeits. angew. Chem. 1899, [11], 245.

See under XXIII., *page* 951.

PATENTS.

New Colouring-Matters [*Orange Yellow on Leather*]; *New Intermediate Products related thereto; Manufacture and Production of.* B. Willcox, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 20,063, Sept. 21, 1898.

See under IV., *page* 908.

Tannic Extracts, and Apparatus for the Manufacture thereof. A. Rainard, Nantes, France. Eng. Pat. 20,680. Sept. 30, 1898.

In the manufacture of tannic extracts the inventor claims the use of nicotine for clarifying the extracts obtained by diffusion; for instance, 1 part of nicotine is added to 4,000 parts of diffusate, at a temperature of 55°—70° C.; the extraneous organic substances are thus precipitated. In combination with the above, the use of a decoction of linseed is also claimed, with the object of imparting to the clarified extract an oily, velvety appearance. The apparatus claimed consists of an evaporator for concentrating the extract systematically from a density of 4° B. to 20° B., composed of three vessels connected together, on the one hand by means of a single heating pipe or worm supplying steam to all three vessels consecutively, and on the other hand by means of a suction tube communicating with a vacuum pump. The concentration of the liquors is thus effected by means of steam, the temperature of which is diminished in proportion as the concentration is more complete. The employment of a filter, consisting of a vessel containing alternate layers of straw and sand, is claimed; also a surface condenser in connection with the evaporator, which keeps the products of condensation separate from the cooling liquid, enabling the recovery of any tannin carried over during boiling.
—J. F. B.

XV.—MANURES, Etc.

Nitro-Nitroso-Manure Bacteria, Permanent Forms of. A. Beddies. Chem. Zeit. 1899, **23**, [63], 645—647.

The isolation of pure cultures of the nitrifying bacteria, presents considerable difficulties. The method of Winogradsky requires special media of gelatinous silica, and the cultures obtained are so sensitive in the vegetative form that they cannot be relied upon for any degree of permanence. For the preparation of these bacteria, the author started with a cloudy liquor obtained from manurial compost in active nitrification and containing about 2 grms. each of organic and inorganic matter per litre. To this was added 1—2 per cent. of meat extract, and the total nitrogen was brought up to 3 per cent. by means of ammonium sulphate, the alkalinity being thus adjusted to 0·02—0·03. This mixture was sterilised and sown, after the addition of some pieces of chalk, with 0·1—0·2 grm. of arable or manured soil. After remaining for some months at 20°—25° C., in absence of sunlight with periodical titration of ammonia, nitrification was completed in most of the flasks. On attempting to isolate pure cultures of the bacteria from the above material by Winogradsky's method, only the sensitive, non-permanent vegetative forms could be obtained, and sporulation could not be induced. Finally the author succeeded in getting permanent cultures by adding to ordinary gelatin media 1 per cent. of a concentrated humus solution and 0·25 per cent. of water-glass solution. The humus solution was prepared by extracting 0·5 kilo. of arable soil with 2 litres of water for two days in the cold. Four species of nitro- and three species of nitroso-bacteria were thus isolated in the pure state. These were quite permanent and extremely resistant. When the media were allowed to dry up, the bacteria became constricted, some of them assuming club-like forms and possessing the heat-resisting properties of spores. On immersing silk threads in the cultures and drying, the spores on the threads were able to withstand a dry heat of 80°—100° C. for several minutes; some of the species also resisted the action of steam at 100° C. for from half to two minutes; others, however, were killed at once. The pure cultures of nitro- and nitroso-bacteria were able to work together in harmony when mixed. Mixtures of the two kinds were dried down on sterile limestone, the product so obtained being used as an admixture with artificial manure with complete success. The spores in this preparation retained their vitality in faintly acid media; in moist, faintly alkaline media they germinated readily, and in dry, distinctly alkaline media they remained indifferent. When mixed with reducing bacteria, nitrification was not impeded if the nitrifying bacteria were in excess, but if the reducing bacteria were in excess, the nitrifying organisms were suppressed, especially if the air supply were restricted.—J. F. B.

PATENT.

Stable Refuse and the like, Treating. F. J. Börner, Berlin. Eng. Pat. 12,679, June 17, 1899.

Powdered natural silicates, such as felspars, clays, granites and basalts, or artificial silicates, such as blast-furnace slag, are heated with about one-fourth of their weight of sulphuric acid, with or without the addition of sodium bisulphate, and the acid mealy product thus formed, mixed preferably with lumps of turf, is sprinkled on the stable bedding, manure heaps, &c., to fix the ammonia.—L. A.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugar Juices, Fermentation of. Orth. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **17**, [1], 30—52.

It is found that diffusion juice, especially towards the end of the season, often contains a considerable quantity of ferments, notwithstanding the fact that from the appearance of the juice and from its analysis it would appear to be quite sound. On the other hand, the absence of ferments in juices that seem to contain a great quantity, may sometimes be proved; for instance, when the loss of alkalinity during evaporation is accompanied by a pronounced turbidity in the syrups.

As regards the sterilisation of the juice, the use of antiseptics may be adopted to prevent incipient fermentation, which is more difficult to check when once started. As regards filtration through infusorial earth, the results the author obtained in the laboratory were not absolutely conclusive. Heating to a temperature of 120° C., possesses no advantages, as it causes an increase in viscosity, an increase of colour when invert sugar is present, and a destruction of sugar, the quantity of which cannot be precisely determined.

Although the viscous ferment differs from *Leuconostoc mesenterioides* by the property of rendering sugar solutions viscous without forming a deposit of viscous carbohydrate under normal conditions, and although a temperature of 75° C. destroys it in a few minutes, it resembles sugar house gum so closely in cultivations on gelatin plates and in size that the author long considered it as identical with *Leuconostoc*. The rapid development of the gum often observed is accounted for by Liesenberg and Zopf by assuming that *Leuconostoc* must occur in the juice with its envelope of dextran. Just as the viscous ferment was found to produce a viscous carbohydrate only in the presence of antiseptics, so dextran would seem to be formed only when the conditions are somewhat unfavourable to development. With the introduction of the diffusion process, the gum disappeared from the raw juice. Now diffusion juice is at a temperature of 30° to 40° C. which is favourable to the growth of *Leuconostoc*, while the juice from the presses was often cold. The presence of 3 to 5 per cent. of calcium chloride favours the formation of dextran; 8 per cent. acts as an antiseptic. The development of dextran and viscose is therefore probably abnormal and protective.
—L. J. de W.

Sugar Solutions, Solubility of Lime in. J. Weisberg. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1889, **17**, [1], 78—81.

Two series of determinations were made, using solutions of pure sugar and an excess of dry lime in the state of powder. In the second series the excess of lime was much greater than in the first. The first series were made at 16–17° C., and the second at 15° C. The flasks containing the mixtures of sugar and lime were left, well corked, for a considerable time and occasionally strongly shaken, before the contents were analysed. The results show that the solubility of lime in sugar solutions is higher than the tables of Berthelot, Petit, Péligot, and Schatten would indicate. It is established that a liquid richer in sugar dissolves more lime than one poor in sugar, and that the quantity of lime dissolved per 100 grms. of sugar in solution is greater in a solution poor in sugar than in a richer solution.

Recent experiments have confirmed the results of Herzfeld and Loiseau, that lime is more soluble in sugar solutions in the anhydrous form and in the state of dry powder (CaO) than in the hydrated form and as milk of lime.

—L. J. de W.

Grossé Process [*Sugar*], *Crystallisation in Movement.* A. Macherez. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **17**, [1], 86—94.

The Grossé process was installed last year at the Venizel sugar factory and worked all through the season. The object of introducing the new apparatus was to hasten the crystallisation of the low products obtained on centrifugalising the first jet massecuites, and to so far exhaust the mother liquors of the second jet massecuites that the syrup "spun off" should be a molasses fit to be sent to the distillery. This end was attained, for, four days after the last beetroot was cut up, the last skipping of the Grossé was ready for the centrifugal apparatus.

The apparatus resembles in form a vertical pan, but of great height. Inside, in the centre, is the elevator cylinder, in the axis of which is a shaft bearing helicoidal agitators arranged at convenient distances apart. The shaft is set in motion by gearing. In the lower part of the apparatus inclined at 44° are the steel coils, the heating surface of which varies with the capacity of the pan.

At Venizel, for an average daily work of 250 tons of beetroots per 24 hours, two apparatus were set up of a capacity of 230 to 250 hectolitres (30 to 35 tons) of massecuite. Beneath each pan is a mixer to hold an entire skipping and distribute it to the centrifugals.

Instead of returning the richer part of the first jet syrup for reboiling, and having an average purity of 72 to 78 for boiling into second jet massecuite, the spun syrup was taken just as made with a purity of 78 to 83. The result was more satisfactory than before and boiling much easier. The syrup grained without difficulty. Towards the end of the operation, however, owing to the richness of the syrup and the low temperature in the pan, there was formation of micro-crystals or smush, to avoid which and to keep a sufficient amount of moisture in the mass, the operation was finished by feeding with molasses from a previous skipping.

The operation is commenced by the smallest possible charge of syrup, graining at 100° C., so as to have grain of average size, and then feeding with syrup in a regular and continuous manner. When only about 30 hectolitres (4 tons) are wanting to complete the boil, the first jet syrup is replaced with exhausted molasses, and boiling continued so as to finish slightly fluid. The evacuation stage now commences. The temperatures at this period are 75° C. below, and 65° to 66° C. at the upper part, if the low-pressure has replaced high-pressure steam at the right moment. It is now necessary to reduce the temperature of the whole mass to from 50° to 55° C. in such a way as to keep it just at saturation point. The mass is kept in motion by the internal cylinder, and, being slightly heated by the coils, evaporates off some of the water on reaching the upper part where the pressure is lower. The evaporation should be prolonged over as long a space of time as possible; thus, if the pan has taken 18 hours to boil, the period of evacuation should last about 40 hours. It may be remarked that the more fluid is the massecuite when exhaustion is commenced, the easier is this to carry out and the better is the result.

The average molasses obtained had a saline quotient of 5·10 and a purity of 60·50. The massecuite obtained by the Grossé was easily centrifugalised and gave a very dry grain of medium size, and rich.

Crystallisation in Movement.—At the Matigny sugar factory, stirring arrangements were put into the old tanks which were square in form and of a capacity of about 80 hectolitres (12 tons). The spun syrups were separated according to quality, the richer portion being returned to the same jet, and the poorer portion to the lower products. The first tanks were worked for 14 days. The purity of the massecuite was 75·50, and its saline quotient 8·40. The syrup spun off at the end of the operation had a purity of 60·20 and a saline quotient of 4·80. Other similar results are given for varying periods of working.

At first sight it would seem as if the process of mixing in the heaters gives results slightly superior as regards exhaustion of the molasses than the Grossé process, the working of which is also more delicate, but it must not be forgotten that it is necessary to run into the mixing tanks massecuites as regular as possible and brought up to the required degree of closeness, otherwise there is a risk that the molasses will not be brought down low enough.

The Grossé process seems to have the advantage as regards time, for it enables one to do in 60 hours, what stirring in tanks would require 15 or even 20 days to accomplish, and besides appears to give more regular results.—L. J. de W.

Juice, The Heating of. M. Melichar. Zeits. für Zuckerind. in Böhmen, 1899, **23**, [11], 691—698.

A considerable amount of heat is often thrown away in the condensed water and vapour from the evaporators; part of the hot water may be utilised for boiler feed, but there remains an excess of heat, principally in the vapour given off from the boiling juice in the last effect, which is condensed and thrown away. The heat in this steam has of recent years been utilised for heating up the diffusion juice, by inserting one or more juice-heaters in place of the usual condenser of the vacuum evaporator. When this heat is wasted in the ordinary way, the evaporation of the juice is more rapid and the economy of fuel is greater, the more perfect the vacuum maintained; but if a juice-heater be inserted instead of the ordinary water condenser, a lower vacuum and consequently a higher temperature in the last effect of the evaporator, gives a greater economy of fuel than the more perfect vacuum but the working capacity is considerably lowered. Hence in a station which is not forced to evaporate to its fullest capacity, a very welcome economy of fuel may be effected by using a lower vacuum; this is proved by calculations for a triple effect working at 55 cm. vacuum = 67° C. vapour temperature and at 64 cm. vacuum = 55° C. in the last member respectively. The most convenient juice for heating in this manner is cold crude diffusion juice at about 20° C.; it may be heated either as it leaves the diffusers for the saturation or else as it is fed into those diffusers just filled with fresh beet slices. As regards the economy of fuel thus effected, it is calculated that with the lower vacuum of 55 cm. and higher vapour temperature, the saving is 1·5 per cent. of coal, and with the better vacuum, 64 cm., the saving is 1·13 per cent. of coal, reckoned on the beets worked; to the latter value must be added 0·14 per cent. of coal saved by evaporating the juice at a higher vacuum and from both totals must be deducted the coal equivalent of the steam required for pumping the juice through the heaters.

The author details his experience gained in the introduction and working of such juice-heaters. After many trials he finds that a single-tube, horizontal heater, through which the juice is forced at a high speed, is the only type which gives satisfactory results. With vertical- and multiple-tube juice-heaters and with intermittent working, deposits are sure to occur and the tubes at the periphery get stopped up whilst the juice only passes through one or two tubes at the centre.—J. F. B.

Sugar Solutions; Solubility of Iron Oxides, Alumina and Silica in. Andrlik. Chem. Zeit. Rep. 1899, **23**, [21], 198. From Böhm. Zeit. Zuckerind. 1899, **23**, 551.

The results confirm the previously known facts that a larger proportion of the substance dissolves by prolonged contact in the cold than after short heating. A portion of the lime combined with silicic acid in natural or artificial silicates, gradually dissolves.—W. G. M.

"Caramel" Mass [Sweatmeat] and its Preparation in the Vacuum Pan. R. Dux. Zeits. für Zuckerind. in Böhmen. 1899, **23**, [11], 699—703.

Sweetmeat "caramel" has no connection with true caramel from burnt sugar. It is prepared by boiling down a solution of cane sugar and starch glucose syrup to the solidifying point, and forms a sweet, hard, glassy mass, more or less colourless, and dissolving with difficulty in the mouth. The specific characteristic of "caramel" is that it is in the amorphous state, and this condition can only be obtained by the addition of a sufficient proportion of glucose syrup. Many authorities regard the glucose as an impurity or as used to prevent stickiness, and quote a limit of 10 per cent. as allowable. But this is not the case; the presence of glucose is essential for the preparation of an amorphous mass, and the 10 per cent. quoted as a maximum is not really sufficient as a minimum proportion. So far from preventing stickiness of the product, a high proportion of glucose increases this quality, and makes the mass more hygroscopic. The natural condition of cane sugar is crystalline, and the "caramel," on keeping, gradually reverts, becoming opalescent and then opaque and granular. It can be preserved for some months in dry closed vessels, but reverts very rapidly on exposure. It also absorbs moisture, and becomes sticky. Naturally, the boiling down is most economically done under vacuum, and a harder, whiter product is obtained, which may therefore contain more glucose than that boiled in the open without injury to its keeping properties. The decomposition products of sugar present in the mass boiled by direct fire, conduce to darker colour, less sweetness, and greater absorption of moisture. The durability of the mass boiled under vacuum varies with the degree of vacuum employed and the rapidity of boiling. In the vacuum pan the initial temperature of boiling is about 60° C., and the finishing temperature 110° C. In the direct heated pans boiling commences about 103° C. and finishes above 130° C. The vacuum pans are constructed for a mass of 25—50 kilos., and the boiling, being pushed as rapidly as possible, occupies about 20—25 minutes per charge. Two forms of steam jacketted vacuum pan are in use, one with removable head and emptied by tipping, and the other with fixed parts, closed by a cone at the bottom. The former kind is more convenient for cleaning and emptying, but the movable head is liable to leaky joints; the other kind is not so easily cleaned, and the cone joint is not always tight. The rule of boiling is, "the quicker the better," within the temperature limits, and practice shows that not less than 8 atmospheres steam pressure and a vacuum of 72 c.m. give the best results.—J. F. B.

Albumin in the Seeds of the Carob Tree, Composition of the. E. Bourquelot and H. Herissey. Comptes Rend. 1899, **129**, [7], 391—393.

In a former communication the authors showed that by the limited hydrolysis of the albumin of the seed of the carob-tree by means of sulphuric acid (3 to 4 per cent.) at 110° C., the products contained galactose and mannose, which could be isolated in a crystalline condition, whilst the residue unattacked by the acid, amounted to from an eighth to a seventh of the original dry albumin. (This Journal, 1899, 848.)

In the present paper they record the results of further experiments made with the object of determining whether any other sugars are produced besides mannose and galactose, and also what is the nature of the residue. The conclusions arrived at from these are that the carbohydrates of this albumin, which, according to Effront, compose four-fifths of it, consist only of a mixture of anhydrides of mannose (mannanes) and anhydrides of galactose (galactanes) in a more or less condensed molecular condition. A considerable amount of the former and the whole of the latter are in the form of hemi-cellulose, and are the part hydrolysed by the sulphuric acid, whilst the residual part of the mannanes consists of manno-cellulose. It is also possible that traces of dextrocellulose may be present, although dextrose was not detected in the products of the hydrolysis.

It is suggested that the seed may be used as a ready means of obtaining crystalline mannose, since the part of the albumin, which can be readily hydrolysed, yields from 40 to 50 per cent. of that substance.—C. A. M.

Mannose in presence of other Sugars, Determination of. E. Bourquelot and H. Hérissey. Comptes Rend. **129**, [6], 339.

See under XXIII., *page* 951.

Molasses Potash, Analysis of. Lacombe. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **17**, [1], 82.

See under XXIII., *page* 947.

Crystalline Melibiose. A. Bau. Woch. für Brauerei, 1899, **16**, [31], 397.

See under XVII., *page* 932.

PATENTS.

New Adhesive Substance or Gum, and Process for the Manufacture thereof. J. Evershed, Kenley, Surrey. Eng. Pat. 18,650, Aug. 31, 1898.

The adhesive substance or artificial gum is prepared by adding boric acid and an alkaline earth to a solution of a carbohydrate. For example, 112 lb. of glucose are dissolved in 4 gallons of water, and, at a temperature of 60° C., 40 to 50 lb. of boric acid and 25 to 35 lb. of calcined magnesia are added alternately, in small quantities, the whole meanwhile being well stirred.—J. L. B.

Colouring Matter [Caramel], Manufacture of. W. McCowan, Greenock. Eng. Pat. 22,765, Oct. 29, 1898.

The patentee heats glucose with about 5 to 10 per cent. of its weight of liquor ammonia (sp. gr. 0·880) in a closed digester to 100° C. for about 24 hours. The mixture is then concentrated, and the syrupy colouring matter obtained is suitable for all the purposes of the substance known as caramel.—T. A. L.

Spent Beetroot, Treatment of, and Production of a Useful Body therefrom. G. B. Ellis, London. From F. Hornig, Taucha, Saxony. Eng. Pat. 22,788, Oct. 29, 1898.

The claim is for producing a soluble adhesive or glutinous substance from spent beetroot chips. This is effected by treating them with hot aqueous sulphurous acid or an aqueous solution of bisulphites of the alkalis or alkaline earths, whereby the insoluble pectin substance contained in the chips is converted into soluble arabic acid.—J. L. B.

Saccharine Liquors, Purifying and Decolorising. O. Imray, London. From Ranson's Sugar Process, Ltd., Paris, France. Eng. Pat. 25,642, Dec. 5, 1898.

The saccharine liquor containing a convenient quantity of sulphurous acid is mixed with tin paste, which has preferably been prepared by electrolysis, and which is free from oxide and other impurities. The liquor is then heated to from 75° to 80° C. and filtered. The tin reduces the sulphurous acid forming tin sulphite, and this, in consequence of its great dilution in the liquor and the increase of temperature, is decomposed into sulphurous acid, and oxide and sulphide of tin. The claim is for the production of hydrosulphurous acid in a nascent state by the action of tin on sulphurous acid.—J. L. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Crystalline Melibiose. A. Bau. Woch. für Brauerei, 1899, 16, [31], 397—400.

An alcoholic solution of purified melibiose was treated at a temperature of 0° C. with barium hydrate and the barium compound separated, washed, and decomposed with sulphuric acid. The syrup obtained on concentration of the filtrate was treated with strong alcohol to a strength of 70 per cent., and incompletely precipitated with ether. After five weeks crystals of melibiose were obtained. The sugar could also be obtained in a crystalline form from aqueous solutions, provided these had not been heated above 80° C., by sowing a crystal, and in this way melibiose was crystallised in presence of fructose from the products of hydrolysis of melitriose by acetic acid. Crystalline melibiose is non-hygroscopic; it is stable at ordinary temperatures in the air and in presence of calcium chloride, but loses water after remaining for a long time over sulphuric or phosphoric acid; it decomposes on heating at 80° C. The water of crystallisation could not be determined directly by heating, because the sugar so readily decomposes. But by long drying over sulphuric acid and by Rüber's circulation method of drying, it was found to have the composition $C_{12}H_{22}O_{11} + 2H_2O$. The crystals sinter at 82°—83° C. and melt incompletely at 84°—85° C., but the melting point is greatly affected by the manner of heating; loss of water, which begins to take place at 70° C., may even cause the melting point to rise 10° C. The crystals were examined by C. Riva, and full crystallographic data are given in the paper; they belong to the monoclinic system, and have been obtained up to 6 mm. in length from 78 per cent. alcohol; those from aqueous solutions are only microscopic.

When freshly dissolved, crystalline melibiose exhibits a diminished rotatory power; this increases rapidly at first, and then more slowly; it is nearly constant after six hours, and after 24 hours it is identical with the value obtained after boiling. The results of many observations are recorded, and the mean of the most reliable values for the final specific rotatory power is given as $[\alpha]_D 20° = + 129 \cdot 38$, which would work out $+ 142 \cdot 99$ for the anhydrous sugar. It is apparently unaffected by variations of temperature between 15° C. and 20° C.; the effect of concentration has not been determined. The cupric reduction for 4 minutes boiling, in quantities such as are used for maltose determinations, amounts to 92—95 per cent. of that of maltose, calculated as anhydrous melibiose. The behaviour of crystalline melibiose towards yeast enzymes and living yeast is identical with that of the amorphous sugar.

—J. F. B.

Raffinose as Carbohydrate Food for Aspergillus Niger. H. Gillot. Bull. Acad. roy. Belgique, 1899, 211—226; Chem. Centr. 1899, 2, [2], 129.

If saccharose be employed as food for *Aspergillus niger*, it is only used as food after being first inverted by a diastase contained in the latter. Oxalic acid is formed as a by-product. On studying the behaviour of raffinose in this relation, it was found that this sugar is also inverted by the diastase of *Aspergillus niger*, indeed, the inversion does not stop with the formation of melibiose, but the latter is further hydrolysed to dextrose and galactose. The raffinose is completely consumed, and in the same space of time as an equal quantity of saccharose, whilst, in this case also, oxalic acid occurs as a by-product.

—A. S.

Yeast, Studies on. Second Communication. C. Boettinger. Chem. Zeit. 1899, 23, [63], 645.

The author was inclined to attribute the absence or delay of true fermentation in the mouldy juice of unripe grapes, to the influence of the sugar contents on this phenomenon. He expressed the juice of unripe grapes, and divided it into two parts without filtration; to one part he added 0·1 grm. per c.c. of grape sugar, and allowed the two to remain and go mouldy. The sample with the added sugar showed greater foaming, colour, and demand for oxygen at the beginning, as compared with the untreated sample. The plain juice, however, went mouldy far more rapidly, and to a much greater extent than the sugared juice, and developed a greater deposit of mycelium. The formation of carbon dioxide in both samples was so small as to be hardly discernible, and on distillation [after 20 days, only minimum quantities of alcohol could be detected by the iodoform test. Hence, contrary to expectation, the chemical behaviour of the two was the same. The effect of adding glucose to a saturated solution of tartar from vine leaves is different: the crystals of tartar at the bottom of the sugared sample become covered with a copious growth of mould after 12 days, whilst those in the plain aqueous solution remain quite free. The author has extended the investigations started in his first communication on the effect of organic substances on the fermentation of glucose by yeast. He dissolved 3 grms. of glucose in 60 c.c. of water, and added 3 grms. of yeast and 1 grm. of 10 various organic compounds. All the samples after 146—168 hours developed copious films and deposits in excess of the ordinary, with the exception of those containing benzaldehyde, pyruvic and glycolic acids. The odours of the liquids varied in nature and intensity. The filtered liquids were evaporated, redissolved in methyl alcohol, and precipitated by ether. The precipitates differed in properties and proportions of sugar, that from glycolic acid being free from sugar; but no separation of the sugar, yeast constituents, and organic substance employed, or their transformation products, could be effected, both precipitates and solutions containing variable proportions of all of these. With pyruvic acid, glyoxylic acid, and benzaldehyde, some sort of combination appeared to be formed between the organic substance and the sugar. In the case of glyoxylic acid some of the acid was converted into oxalic acid, but only very little of the remainder could be recovered. Even on precipitation with lead acetate the combination of acid and sugar remained in the filtrate, and was obtained on purification as a syrup yielding crystals with 74·81 per cent. of sugar on the dry substance. Besides the organic substances mentioned, paraldehyde, acetone, acetic, tartaric, citric, and oxalic acids were used in the experiments.

—J. F. B.

Pure Yeast Question, Some Aspects of the. A. J. Murphy. J. Fed. Inst. of Brewing, 1899, 5, 432—455.

In this paper the pure yeast question is dealt with under the following heads:—

1. The pros and cons of the question.
2. Some influences determining final attenuation.
3. Action of single cells compared with the mixture from which they have been derived.
4. Some general conclusions.

Amongst other points, the author has studied the action of light on fermentation, and he found that within small limits the amount of light entering a fermenting room is without any influence. The effect of different salts, added at the time of seeding, on the attenuation of worts has been investigated, but no positive results were obtained. Other experiments were made to ascertain how far a mixed yeast would differ from single cells (derived from this mixture) in their action upon the same wort under identical conditions. No very definite conclusions can be drawn from these experiments, because the yeasts do not acquire an established character until they have been many times cultivated under the same conditions; but so far as they go they favour the possibility which Jörgensen and others contend for, that one or more single cells can be isolated from any given mixture, which will do all the work of that mixture more completely, more uniformly, and with greater certainty. If the single-cell yeast system is to be employed in this country, the author considers that the two most important precautions to be taken are: (1) that the cell should be isolated from the yeast actually in use in the brewery for which the pure culture is intended, at the psychological moment; (2) that during its isolation and through all its early stages of growth, no nutrient medium should be used except wort from that same brewery.

Stress is laid upon the influence which inorganic elements may have upon the formation and action of enzymes, and particularly that of phosphorus when in organic combination. —J. L. B.

Yeast, Nutrition of.—Part II.: Odour of the Gases evolved during Fermentation. A. L. Stern. J. Fed. Inst. of Brewing, 1899, 5, 399—405. (See this Journal, 1898, 1167.)

In the first portion of this investigation it was observed that the gases evolved during fermentation always have an unpleasant odour, due to the presence of sulphuretted hydrogen or some of its compounds.

Since the substances present in the experimental solutions before the addition of yeast were dextrose, asparagine, potassium phosphate, magnesium and calcium sulphates, the sulphuretted hydrogen must owe its origin to the sulphates. It is shown that sulphates play a very important part as yeast food, and that in their absence the functions of the yeast are materially restricted.

The yeast when fermenting malt worts, produced no unpleasant-smelling gases, whereas it did when fermenting the artificial solutions. The author thought that this might be due to the malt worts containing some sulphur compound which served as a yeast food without the production of any sulphuretted hydrogen. Comparative experiments were made in which this thiocarbamide, potassium sulphocyanide, sulphonal, sulphur, and sodium thiosulphate were substituted for the sulphates. The first three of the above substances could not take the place of sulphate for yeast food. The fermentation in presence of thiosulphate and sulphur was fairly complete: the gases evolved from the former contained mercaptan; those from the latter sulphuretted hydrogen. These results were unsatisfactory so far as the above hypothesis is concerned. It was thought possible that there might be some peculiarity in the constition of asparagine which caused the production of the unpleasant odour when this substance was being used as a yeast food. To test this, experiments were carried out in which the asparagine was replaced by leucine, urea, tyrosine, or alloxan. The gases evolved during fermentation were free from any odour of sulphuretted hydrogen, and each fermentation had a distinctive smell, so that it was possible by this to recognise the particular nitrogenous food which had been added. Comparing the experiments in which leucine was substituted for asparagine, it was found that the fermentations were equally complete, the yeast crop, the amount of nitrogen assimilated, and the percentage of nitrogen contained in the yeast being slightly less so. With urea the fermentation was complete. Tyrosine gave similar results. Experiments showed that alloxan was not a suitable yeast food. These results show that the odour of a fermentation is determined by the nitrogenous food used; further, that whilst many nitrogenous compounds can supply yeast with food that will enable it to almost completely ferment dextrose, yet, with the same amount of nitrogen supply, they all differ as to the amount of yeast crop produced, the amount of nitrogen assimilated, and the percentage of nitrogen which is contained by the yeast.—J. L. B.

Nitrates in Brewing, Influence of. L. Briant. J. Fed. Inst. of Brewing, 1899, 5, 372—385.

The author believes that the conclusion is justified that nitrates are directly poisonous to yeast, even when they exist in so small a proportion as 0·0035 grain per gallon. Any water containing nitrates must be condemned for brewing purposes. They usually indicate active decomposition of organic matter, and in most cases show that a water contains putrescent organic matter.

Nitrates, if existing in quantities exceeding 3 or 4 grains per gallon, are a possible source of danger, and this apart from the simultaneous presence of organic matter, though if the latter be present, the danger is undoubtedly much greater. The difficulties met with are, enfeebled yeast, erratic fermentations, occasionally high-coloured beers, and usually decreased soundness. Beers brewed from such waters often mature rapidly, and, as a consequence, seldom keep.

There are no practicable means for removing nitrates from brewing waters; and, from the results of experience in dealing with waters containing nitrates, the author points out the importance of (1) securing a healthy, vigorous, and rapid fermentation and attenuation; (2) if necessary, to increase the proportion of yeast in order to attain this end; (3) to employ a highly attenuative yeast, to feed it, if necessary, with readily assimilable nitrogenous food, and, so far as possible without unduly retarding fermentation, to keep the fermentation heats fairly low, *i.e.*, not exceeding 69° F.; (4) to use the outcrop of yeast whilst quite fresh.

Nitrates do not exert any appreciable influence upon the general composition of the carbohydrates of a wort, nor do they affect the amount of albuminoids or of salts dissolved. They are without influence on diastase, and do not influence the extraction of hops. In some cases a dark-coloured wort is obtained; but where coloration occurs it is not necessarily before, but often after fermentation, and the difficulties which are experienced are probably due to direct action upon the yeast itself rather than to any modification of the composition of the wort in which the yeast grows. —J. L. B.

Mash, The Relation of the "Initial Heat" to the "Striking Heat" of the. H. T. Brown and G. H. Morris. J. Fed. Inst. of Brewing, 1899, 5, 338—350.

It is a matter of common experience that the "initial heat" of a mash—that is, the temperature immediately after mixing the grist with the hot mashing liquor—is subject to variations, even when the mashing is conducted on exactly the same lines as regards the relative quantity of malt and water used, and their respective temperatures. These variations are often considerable, not only between different malts, but even between mashes made with the same malt at different times. The cause of the differences arises from the evolution of heat when brewers' materials, such as malt, starch, grains, &c., are mixed with water. The principal determining factor is the degree of dryness of a malt; thus, a dry malt will evolve more heat than a slack malt, and the percentage of moisture may, within certain limits, be used as a means of determining the amount of heat which a malt will liberate. It is pointed out that the drier the malt the greater is the difference in the amounts of heat which are evolved for each successive percentage of water. Thus, when the water in a malt rises from 2 to 3 per cent., there is a decrease of 3 calories in the heat evolved, whilst when the rise is from 6 to 7 per cent., the decrease is only 1·7 calories. The heat of hydration of flaked maize is found to agree with that of malt.

The specific heat of malt is given in the works consulted by the authors as 0·42. The authors made several attempts to directly determine the specific heat of malt, but failed, owing to the nature of the material and the imperfect apparatus at their disposal. In practical experiments on a large scale, the temperatures of the grist and of the water, the quantities of the grist and of the water, the percentage of water in the grist, and the initial temperatures were all carefully observed; the thermometers were verified; the initial heats were taken in various parts of the tun, and when the readings differed the mean temperature was taken as correct. When the results were worked out, making proper allowance for the heat of hydration, they agreed best when the value for the specific heat of malt was taken as 0·52. This value has, therefore, been adopted by the authors in all their calculations as the specific heat of dry malt.

The authors have constructed a table (see top of next page), in which is given the "initials" for any striking heat from 154° to 170° F. In the table the malt is taken as containing 2 per cent. of water, and 0·2° must be added to the given temperature for each percentage below this amount, or be subtracted for each percentage above 2 per cent.

The next table shows the rise in temperature in the mash due to the combined heats of hydration and hydrolysis when malts with varying percentages of moisture are mixed with water in the proportions of 2, 2¼, 2½, 2¾ barrels per quarter respectively. The heat of hydrolysis has been included, which amounts to 1·41 calories (°F.), on the assumption that malt contains 50 per cent. of starch, and

Table showing the Temperatures resulting from mixing Malt and Water of different Temperatures when Quantities and Specific Heats only are taken into consideration. Specific Heat of Malt containing 2 per cent. of water = 0·53 (dry malt = 0·52).

Water Temperature.	Malt at 55° F. Barrels per Quarter.				Malt at 60° F. Barrels per Quarter.				Malt at 65° F. Barrels per Quarter.				Malt at 70° F. Barrels per Quarter.			
	2.	2¼.	2½.	2¾.	2.	2¼.	2½.	2¾.	2.	2¼	2½.	2¾.	2.	2¼.	2½.	2¾.
170	147·1	149·3	150·9	152·3	148·2	150·2	151·8	153·0	149·2	151·2	152·6	153·8	150·1	152·0	153·4	154·6
169	146·3	148·4	150·1	151·4	147·4	149·3	150·9	152·2	148·4	150·2	151·8	153·0	149·3	151·1	152·6	153·7
168	145·5	147·6	149·3	150·6	146·6	148·5	150·1	151·4	147·6	149·4	150·9	152·1	148·5	150·3	151·8	152·9
167	144·7	146·8	148·5	149·8	145·8	147·7	149·3	150·5	146·8	148·6	150·1	151·3	147·7	149·5	150·9	152·0
166	143·9	146·0	147·6	148·9	144·9	146·9	148·5	149·7	146·0	147·8	149·2	150·5	146·9	148·7	150·1	151·2
165	143·1	145·2	146·8	148·1	144·2	146·1	147·6	148·8	145·2	147·0	148·4	149·6	146·1	147·9	149·3	150·3
164	142·3	144·3	146·0	147·2	143·4	145·2	146·8	148·0	144·4	146·1	147·6	148·8	145·3	147·0	148·5	149·5
163	141·5	143·5	145·1	146·4	142·6	144·4	146·0	147·2	143·6	145·3	146·7	147·9	144·5	146·2	147·6	148·6
162	140·7	142·7	144·3	145·6	141·8	143·6	145·1	146·3	142·8	144·5	145·9	147·1	143·7	145·4	146·8	147·8
161	139·9	141·9	143·5	144·7	141·0	142·8	144·3	145·5	142·0	143·7	145·1	146·3	142·9	144·6	146·0	146·9
160	139·1	141·1	142·6	143·9	140·2	142·0	143·5	144·6	141·2	142·9	144·2	145·4	142·1	143·8	145·1	145·1
159	138·3	140·2	141·8	143·0	139·4	141·1	142·6	143·8	139·4	142·0	143·4	144·6	141·3	142·9	144·3	145·2
158	137·5	139·4	141·0	142·2	138·6	140·3	141·8	143·0	138·6	141·2	142·6	143·7	140·5	142·1	143·5	144·4
157	136·8	138·6	140·2	141·4	137·8	139·5	140·9	142·1	137·9	140·4	141·7	142·9	139·7	141·3	142·6	143·5
156	135·9	137·8	139·3	140·5	137·0	138·7	140·1	141·3	137·0	139·6	140·9	142·1	138·9	140·5	141·8	142·7
155	135·1	137·0	138·5	139·7	136·2	137·9	139·3	140·4	136·2	138·8	140·1	141·2	138·1	139·7	141·0	141·8
154	134·3	136·1	137·7	138·8	135·4	137·0	138·4	139·6	135·4	137·9	139·2	140·4	137·3	138·8	140·2	141·0

NOTE.—For temperatures of malt intermediate between those given above, add to the mixing temperatures when mashing with 2, 2¼, 2½, 2¾ barrels per quarter 0·2°, 0·18°, 0·16°, 0·14° F. for each degree above 55°, 60°, 65°, 70° F. respectively.

that 70 per cent. of apparent maltose is produced from this under ordinary mashing conditions :—

Percentage of Water.	2 barrels per Quarter.	2¼ barrels per Quarter.	2½ barrels per Quarter.	2¾ barrels per Quarter.
0	10·87	9·87	9·06	8·43
1	9·55	8·67	7·96	7·41
2	8·37	7·60	6·96	6·42
3	7·39	6·70	6·17	5·74
4	6·41	5·83	5·34	4·93
5	5·60	5·10	4·68	4·36
6	4·87	4·43	4·07	3·78
7	4·20	3·82	3·52	3·28
8	3·68	3·35	3·08	2·87
9	3·18	2·89	2·66	2·48
10	2·71	2·46	2·27	2·10

The following example of the application of these tables will explain their use: In working with a malt containing 2 per cent. of moisture, it is desired to know at what temperature the mashing liquor must be used in order to obtain an "initial" of 151° F. when the grist is at 65° F. and mashing at a rate of 2¼ barrels per quarter. On reference to the second table, the natural rise due to the heat of hydration of a malt containing 2 per cent. of water when it is mixed with water at the rate of 2¼ barrels per quarter, is 7°·6 F. Then 151° − 7°·6 = 144°·4. On referring to the section of the first table, headed malt at 65° F., under the sub-heading of 2¼ barrels, it is found that an "initial" of 144°·5 is given by a water temperature of 162° F. The "striking" heat of 162° F. would therefore be necessary to obtain an "initial" of 151° F.—J. L. B.

Wines in France, Treatment of. U.S. Consular Reports, 1899, **60**, [227], 613—615.

THE report contains an abstract of an article contributed to the Viticulturists' Society of France by M. Gayon, of Bordeaux, on the prevention of disease in wine. Infection most frequently occurs during the alcoholic fermentation; for this reason, too high a temperature in the vats must be avoided, the grapes should be cooled, and should be left but a short time in the vat, and tartaric acid should be added to the must when its natural acidity is too low. If the wine be initially of good quality, it is practically safe during the subsequent operations, if only clean vessels be used. But if it contains germs of disease, only preventive measures are of any avail, wine once diseased cannot be cured. Sometimes the germs can be eliminated by settling during storage at a low and even temperature, and decanting when perfectly limpid. Sterilisation by filtration is not recommended for wines of fine quality, but is well suited for common wines; freezing makes the wine more concentrated by separating some of the water as ice; it is then less susceptible to attack. The use of antiseptics is most inadvisable, since if these are added in sufficient quantity, the flavour is often spoilt and health is endangered. The best way of treatment of all doubtful wines is by pasteurisation. This should be applied on the appearance of the first symptoms of sickness, as indicated by microscopic examination and increase of acidity. Pasteurisation may be done during the first months after cessation of fermentation and the casks can then be stored on end, economising space; it has been proved that pasteurisation does not interfere with the proper ageing of the wine. The wine to be treated must be perfectly clear, otherwise the suspended matter may be partially dissolved; in order to preserve all the normal characteristics of the wine, the heating and cooling must be done in absence of air, pasteurisation in bottles answers this purpose best. For common wines, the judicious admission of air during pasteurisation artificially hastens the ageing process.—J. F. B.

Fission Fungi [Schizomycetes], Fermentation by. O. Emmerling. Ber. 1899, **32**, [11], 1915—1918.

THE author describes the fermentation of malic acid brought about by a pure culture of a bacillus isolated from putrefying meat extract, possessing all the characteristics of *B. lactis aërogenes* obtained by Escherisch from the entrails of infants.

A solution of 20 grms. of malic acid in 500 c.c. of water was rendered nutrient by the addition of salts and peptone, after neutralisation with the faintest excess of sodium carbonate. This was sterilised and sown with the pure bacillus. After 14 days a slimy deposit had rendered the whole liquid opaque, and all the malic acid had disappeared. The products of fermentation from the above quantity of malic acid consisted of 4·5 grms. of carbon dioxide, 3·2 grms. of volatile acid, practically entirely acetic with traces of formic acid, and 11·5 grms. of succinnic acid; no alcohol could be detected. This result closely corresponds with the equation given by Fitz (Ber. **11**, 1896) for the fermentation of malic acid by an unknown bacillus or mixture of organisms :—

$$3C_4H_6O_5 = 2C_4H_6O_4 + C_2H_4O_2 + 2CO_2 + H_2O.$$

It is generally stated that beer-yeast is able to ferment malic acid with formation of succinic acid, but this statement is contrary to the author's experience, which shows that such fermentation only takes place when the yeast is contaminated with bacteria.—J. F. B.

Glycerin, during the Alcoholic Fermentation of Sugar, Variations in the Production of. I. Laborde. Comptes Rend. **129**, [6], 344—347.

A grape must, containing 180 grms. of sugar per litre, fermented with different yeasts, gave amounts of glycerin varying from 2·50 grms. to 7·75 grms. per 100 grms. of sugar decomposed. The average was about 3 grms., and the high figures were given chiefly by yeasts of low alcohol-generating power.

The same yeast, fermenting different media of equal sugar-content, gives different amounts of glycerin (2·50 to 4·56 per 100 of sugar decomposed, in the author's experiments); and the amount appears to vary inversely with the *activity* of the yeast. The addition of organic matters, such as Liebig's extract, yeast extract, peptone, &c., affects the production of glycerin; always, it seems, in the inverse direction to the effect on the rapidity or vigour of the fermentation.

Increase in concentration of the sugar from 180 to 300 and 400 grms. per litre increased the production of glycerin from 2·90 to 4·95 and 6·10 for each 100 of sugar decomposed. This appears to be due to the excess of sugar affecting the activity of the yeast; for with a Sauterne yeast, habituated to concentrated musts, the glycerin production, always high, varied little with the concentration of the sugar.

Increase in the acidity of the must by addition of tartaric acid, increases the yield of glycerin, to an extent varying with the nature of the yeast. The nature of the acid added also influences the result. Slight alkalinity seems to be without influence.

Rise of temperature also increases, as a rule, the yield of glycerin, though to an extent depending on the nature of the yeast. In some cases, twice as much is formed at 35° C. as at 15° C.

The same yeast, fermenting different sugars, gives rise to different amounts of glycerin; with one yeast, 2·15 for galactose or lactose, 2·45 for glucose, levulose, sucrose, or maltose.

During the progress of fermentation the rate of glycerin production diminishes; partly, no doubt, from the direct action of the alcohol produced, but also because the glycerin, being, no doubt, a residue of the sugar employed in the construction of the yeast cell, is formed more rapidly whilst the yeast is in vigorous growth.—J. T. D.

Brewing, Procházka Method of. C. Bleisch. Zeits. für d. ges. Brauw. **22**, [20], 264—265.

The author cites Cerny's opinion (Oesterr. Brauer- u. Hopfen Zeit. **12**, [7]), that the division of the goods into clear mash and grain mash and their subsequent reunion, combined with the prolonged exposure to saccharification temperature, and the special method of aërating the mash and wort (this Journal, 1895, 981), form the chief advantages of the process, a considerable saving of fuel (630 kilos. of lignite per 100 kilos. of beer) being also effected. He, however, considers that the influence of the method on the yield of extract is but small, and is only appreciable in the case of hard malts; furthermore, that the preservation of the diastase is not always desirable, *e.g.*, in the preparation of Bavarian beers; neither does he understand the object of aërating the mash, since the hot air might exert considerable influence on the imperfectly transformed soluble carbohydrates therein, as well as on the hop constituents of the wort. On the other hand, he agrees with Cerny that the omission to boil the united mash before removal from the tun, is a defect which impedes the clarification of the wort, though he does not share the opinion of the latter as to the favourable influence of the Procházka method on the stability of the finished beer, since this result depends more on the treatment of the wort in the subsequent stages of brewing.—C. S.

Colorimetry of Beer and Wort. J. Brand. Zeits. für d. ges. Brauw. **22**, [19], 251—253.

Having ascertained that certain coal-tar dyestuffs enter into the composition of some commercial preparations for colouring beer, the author experimented with similar dyes as material for the production of standard colorimetric shades for the examination of wort and beer, and found the following mixture afford the best results: Victoria yellow, 10 parts; Patent blue V, 1 part; Fast brown O, 2·5 parts; Bordeaux B extra, 4 parts. The aqueous solution (1·15 grms. per litre) is equal in colour shade to $\frac{N}{10}$ iodine solution, and continues equivalent to the latter when both are equally diluted, but is superior in point of stability, especially if a little chloroform be added to prevent the growth of mould fungi. A graduated series of standard solutions of known content are prepared and stored in flat-sided, stoppered glass bottles, kept in the dark.

The colorimeter resembles a box stereoscope, minus the lenses, and is fitted at the base with a sheet of frosted glass, the interior being divided into three compartments by transverse partitions. The sample to be tested is placed in a similar bottle to those used for the standard solutions, and put into the central compartment of the colorimeter, the two members of the series most nearly resembling the sample being placed, for comparison, in the side compartments.

This method is regarded by the author as preferable to titration, because affording a direct colorimetric reading, in which two solutions are viewed under the same conditions. Besides, the colour scale can be extended without difficulty, and the colour depth of dark beers can be determined direct, a result unattainable by any other system. Moreover, regularity of colour in successive brews can be checked by this method, since, once it has been ascertained what volume of the dye solution is required to match any particular beer, the same standard can be reproduced, whenever desired, from the unalterable dry mixture already given.—C. S.

Vermuth in Europe, Preparation of. U.S. Consular Reports, 1899, **60**, [227], 599—613.

In France the production of vermuth is almost entirely confined to Marseilles. It is an infusion of bitter and aromatic plants, herbs, and roots in good white wine; the wine, however, generally has to be fortified by the addition of alcohol. The ingredients used are very numerous, and the number of different formulæ practically unlimited. Several formulæ are quoted in the reports, but it is remarked that each manufacturer uses his own combination, which he keeps a profound secret. But Italy is the largest producer of vermuth, and the most highly-esteemed and extensively-sold vermuth is made at and around Turin, which is the centre of the manufacture. The methods employed fall under three heads:—

I. Vermuth made from natural wine: (*a*) with vegetable substances; (*b*) with extracts.

II. Vermuth made from alcoholised wine.

III. Vermuth made from "new (unfermented) wine."

The first essential for making good vermuth is a basis of good white wine of a sweet and smooth nature, and for this purpose moscato is most generally employed, although other wines of a similar character are also used.

I. (*a*) A quantity of good white wine is placed in a clean wine-barrel, and the vegetable ingredients, broken into small pieces, are then added. These may be put in loose, or preferably enclosed in a cotton bag, which is suspended in the middle of the barrel. After digesting for four or five days, the bag is taken out, squeezed, and then put back, this treatment being repeated for a month or more, until the drugs are exhausted. When the wine is saturated with the aromatic principles, it is filtered through a filter of any convenient material, which must be so clean as not to impart any foreign flavour to the vermuth.

I. (*b*) Vermuth is generally made on the large scale by preparing an alcoholic infusion or extract of the herbs, by digesting them in 95 per cent. alcohol for 8 days, at a temperature of 120° F., and then warming to a moderate degree over a slow fire for 12 hours; the ingredients are then pressed, and the extract is filtered ready for use, and added to the wine as desired. Different makers vary greatly in the ingredients used for making vermuth, but the following formulæ may be quoted as an example of the preparation of such an extract :—

Articles.	Quantity.	
Alcohol, 90°	8 litres	8·45 quarts.
Coriander seed	800 grms.	12,344 grains.
Nutmeg	200 „	3,086 „
Greek nuts	200 „	3,086 „
Cloves	100 „	1,543 „
Ceylon cinnamon	100 „	1,543 „
Peruvian bark	200 „	3,086 „
Dittany	50 „	771 „
Rose leaves	100 „	1,543 „
Yarrow	180 „	2,777 „
Hyssop	150 „	2,314 „
Sweet marjoram	180 „	2,777 „
Semiangelica	50 „	771 „
Wormwood, sharp	720 „	11,109 „
Roman wormwood	720 „	11,109 „
Sweet flag	200 „	3,086 „

II. The alcoholic strength of vermuth lies between 15 and 17 per cent., and it is often necessary to fortify the wine used in its preparation. Only the best spirits should be employed for this purpose, and the alcohol should be added before converting the wine into vermuth. The vermuth consumed in Italy has a lower alcoholic strength than that which is exported, and, in this case, alcohol is often added in the export casks.

III. The method of adding the ingredients to the must during fermentation is but little used ; when this is done, they are allowed to infuse for some time after fermentation has ceased. The principal art in making vermuth, given good materials and wine, lies in obtaining constancy of product. Each maker aims at producing an unvarying article, characteristic of his brand ; this is difficult to attain on account of variations in the wine used as a basis, which has to be blended by experts to a uniform standard.—J. F. B.

Saccharin in Beer, &c., Detection of. R. Rössing. Zeits. öffentl. Chem. **5**, 207. Chem. Centr. 1899, **2**, [4], 274.

See under XXIII., *page* 947.

Aldehydes in Alcohols, Detection of. C. Istrati. Zeits. Anal. Chem. 1899, **38**, [8], 517.

See under XXIII., *page* 947.

PATENTS.

Malting, Drying, and otherwise Treating Grain and the like, and Apparatus therefor. S. White and J. Sleeman, Somerset. Eng. Pat. 18,412, Aug. 27, 1898.

The claims relate to the combination of a cylindrical vessel capable of being rotated, the interior of which is divided into compartments, the partitions being formed hollow with (or without) a division wall impervious to air, and two gauze or perforated walls, the chambers formed thereby and those attached to the ends of the cylindrical vessel being so connected with the supply and exhaust trunks that the air cannot proceed from the supply to the exhaust without passing through the grain. The combination of the above described partitions in a fixed vessel of suitable shape, a supply pipe and air ducts connected with certain of the chambers, a central exhaust tube connected with the exhaust trunk and with certain others of the chambers, are also claimed, and a false or movable bottom to each compartment and a conical bottom to the vessel, are provided.—J. F. B.

Sweetening Casks. C. Lampitt, London ; A. J. Carlile, Burton-on-Trent ; and C. Simkin, London. Eng. Pat. 20,478, Sept. 28, 1898.

The use and application of ozonised or electricised, allotropic, nascent or excited oxygen at a pressure above 90 lb. per sq. in. for the purpose of sweetening foul casks, are claimed. The other claims relate to means by which the casks are supported and strengthened so as not to burst whilst subject to so high a pressure. The heads of the casks are supported by discs screwed up together with the cask between them, whilst the staves are strengthened by any number of chains, ropes, or bands arranged round the circumference, these chains, &c. being hooked together with a hook-and-screw coupling.

The use of a circular frame opening on hinges, and provided with holes which engage tubes connected with threaded bolts attached to blocks for the purpose of tightening up the same and securely gripping the casks, is also claimed as an alternative arrangement. A bung-hole-closing and gas-admitting device is claimed, provided with shouldered ends to catch the inside of the bung-hole stave and secured by an anchor bolt ; an alternative device which can also be used for exhausting, is likewise claimed.—J. F. B.

Alcoholic Liquids, Purification of. J. T. Hewitt, Sydenham. Eng. Pat. 22,607, Oct. 27, 1898.

This is an extension of Eng. Pat. 15,452 of 1898 (this Journal, 1899, 62) and provides for the addition to the spirit before distillation of a primary hydrazine, and for the removal by known means from the distillate, of any hydrazine which may have passed over therewith. The previous specification, just referred to, omitted to claim the use of a free hydrazine base because of its volatility with steam, but this fact is now remedied by removing it by fractional distillation, or by redistilling after fixing the base with some non-volatile acid.—J. F. B.

Beer [*Use of Ozone*], *Process of Manufacturing.* P. Kropf, Chicago, U.S.A. Eng. Pat. 22,355, Oct. 24, 1898.

The claims cover the process of fermenting beer for from 8 to 12 days, and then introducing ozonised or electrically-ozonised air into the wort for from 4 to 6 hours during the latter part of the fermentation. This treatment obviates the necessity of the secondary fermentation and brings the beer into such a condition of ripeness that in 14 days beer can be produced equal to that which requires 40 or 60 days by the older methods ; in addition to this, all noxious germs are effectually destroyed by the ozone.—J. F. B.

Accelerating Alcoholic Fermentations, and at the same time obtaining Pure Carbon Dioxide. A. Grauaug, Bosnia, and J. Kranz, Vienna. Eng. Pat. 14,150, July 8, 1899.

The claims relate to a process for accelerating and rendering more remunerative alcoholic fermentation processes, consisting in leading off the carbon dioxide generated together with the volatile by-products from all layers of the fermenting body, whilst this is always subject to normal pressure at its surface. Also for purifying the carbon dioxide obtained, which is mixed mainly with alcoholic and empyreumatic substances by subjecting the gases to the action of washing apparatus under pressure, for the purpose of retaining in the washing medium the constituents soluble therein beyond the point of saturation, while on decreasing the pressure, the carbon dioxide is subjected to a second washing process in the same battery vessels. In combination with this process there is claimed the process of purifying the carbon dioxide from condensable impurities by first heating the gas mixture coming off from the washing battery, and then suddenly cooling the same. The inventor claims the use, for the purpose of collecting the gases of fermentation, of a collector which is completely submerged in the fermenting mass, and the sides of which are provided with shielded openings, so that the liquid may circulate freely, whilst the gas is led by the shields of the openings from its points of generation into the interior of the collector, and thence into a receiver.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Coagulated Gluten, and the Nitrogenous Matters of Flours. Balland. Comptes Rend. **129**, [5], 312—314.

Gluten freshly extracted from flours, if plunged into boiling water, first sinks, but after a little time floats. It has become spongy, is no longer sticky, and does not become so again on immersion in water. The amounts of water in "coagulated" gluten from various flours are less widely variable than in the freshly-extracted glutens; and for this reason, as well as on account of the ease of handling it, this form is well adapted for gluten determinations. Whilst useful comparative results can thus be obtained however, it must be borne in mind, first, that the gluten extracted in the usual way is of variable composition, and contains more or less of the starch, cellulose, fat, and mineral matter of the flour; and second, that the gluten does not represent the whole of the nitrogenous matter of the flour, some being always carried away in the wash-water. The older the flour, the larger the quantity thus carried away.—J. T. D.

Butter, Volatile and Insoluble Fatty Acids in. A. Juckenack. Chem. Rev. Fett- u. Harz-Ind. **6**, [6], 112—113.

The author agrees with Henriques (this Journal, 1898, 1067) that the mean molecular weight of the volatile and insoluble fatty acids affords an indication of the purity or otherwise of butter, and recommends, in addition, the employment of the Reichert-Meissl value as a corroborative factor, since he finds that whereas in butter of known purity this value works out at about 28—the mean molecular weight of the fixed acids being 259·4—260·3—it falls to between 16 and 18 in the case of adulterated butters, the said molecular weight concurrently increasing to 267—269. —C. S.

Albumins, Crystalline Form of the. A. Wichmann. Zeits. physiol. Chem. **27**, 575—593; Chem. Centr. 1899, **2**, [7], 393.

Harnack (Ber. **23**, 3745; this Journal, 1891, 360) has described crystalline compounds of albumin with ammonium sulphate, which contain a very small proportion of albumin. The author shows that these alleged compounds were really crystals of ammonium sulphate enclosing some of the mother-liquor containing albumin.

Serum albumin, egg albumin, and milk albumin ("Laktalbumin") yield crystals of the same form and having the same optical properties. On mixing the solutions of the different albumins, perfectly formed crystals are obtained, so that even if the different crystallisable albumins be not identical, they are at least isomorphous.—A. S.

Egg Albumin, Crystallisation of. T. B. Osborne. J. Amer. Chem. Soc. 1899, **21**, [6], 477—485.

The fact that an addition of acetic acid to the half-saturated ammonium sulphate solution greatly assists the crystallisation of egg albumin (Hopkins, J. Physiol. **23**, 131), is attributed by the author to the formation of an acid compound of the albumin during the process. When acetic is not added, it is necessary to reprecipitate the albumin several times in order to obtain it in a crystalline state, evidently on account of the slow formation of the necessary acid. By substituting hydrochloric acid in a molecularly equivalent quantity for the acetic acid, the crystallisation is effected more rapidly and apparently more completely. Thus, by the addition of acetic acid to 1,500 c.c. of white of egg, the author obtained in the first crystallisation 29 grms. of precipitate, whilst with hydrochloric acid the amount was 59 grms. Further yields were obtained from the mother-liquors.

In order to neutralise these preparations, it was necessary to add to 1 grm. from 2·05 to 2·30 c.c. of decinormal alkali, with phenolphthalein as indicator, and from 1·30 to 1·65 c.c. with litmus as indicator, the difference being from 0·65 to 0·75. The author points out that if Sabanejeff's estimation of the molecular weight of albumin (15,000) be correct, 1 grm. would react with 0·67 c.c. of decinormal alkali—a quantity closely corresponding with the difference of acidity as shown by the two indicators. With lacmoid as indicator the preparations were distinctly alkaline.

The nature of the acid or acids united with the albumin, was not determined, but it appeared to be principally, if not entirely, of an organic nature.

On heating aqueous solutions (2·5 per cent.) of the first fractions of the albumin preparations, they became turbid at 58° to 59° C., and at 59° to 60° yielded a slight flocculent precipitate, which increased in quantity on raising the temperature, until at 70° C. most of the dissolved albumin had coagulated. When sodium chloride (10 per cent.) was also present, only traces coagulated below 64° C., and the solutions filtered from this, remained clear until nearly 70° C., when the albumin began to coagulate, though it was not until 84° C. that the bulk separated. The final fractions yielded in the crystallisation, behaved in a similar manner, with the difference that the quantity coagulating at 60° to 64° C. was considerably greater; this was probably due to the presence of a different substance. The degree of acidity was found to have a considerable influence on the coagulation, and when the preparations were exactly neutral to phenolphthalein, the albumin was not coagulated even on boiling the solution. From the results of a number of determinations with materials of different degrees of acidity, it appeared that 3 mols. of acid were required to one of albumin in order to form the coagulable substance.

The specific rotation of the less soluble fractions averaged from − 28·14 to − 29·23, whilst the figures obtained with the more soluble fractions were − 33·3 and − 39·31. An addition of either acid or alkali to the solutions, considerably increased the rotation.

Elementary analyses of seven fractionally crystallised preparations, showed that the amount of sulphur in egg albumin is greater than that given by Hofmeister (1·01 and 1·18). The author concludes that his investigation, taken in conjunction with the results of Bondzynski and Zoja and of Panormoff, plainly show that there are two proteid substances in white of egg, and that a mixture of these is commonly obtained in preparing egg albumin by the usual processes.—C. A. M.

Albumin, A New Preparation of (Siebold's Milk-Albumin, "Milcheiweiss"). W. Prausnitz. Chem. Zeit. Rep. 1899, **23**, [21], 207. (From the Münch. med. Wochenschr. 1899, **46**, 849.)

The new preparation is made from milk caseïn and sodium bicarbonate, and is known in commerce under the name "Plasmon." The albuminous substance obtained from the milk is mixed with the necessary quantity of sodium bicarbonate to ensure solution, and is worked in a kneading machine at 70° C., carbon dioxide being introduced, and it is then broken up. The preparation, when dried, contains 13 per cent. of nitrogen and 8 per cent. of ash. It is a yellowish gritty powder, completely soluble in warm water; with a little water it swells up to a more or less viscous or gelatinous mass. It is quite without odour or taste, is readily taken, and is easily assimilated (often better than meat, which it may completely replace), as is evidenced by the small percentage of nitrogen in the excrement. The trial of the food was made upon four or five persons, all the food used being carefully examined. The author points out the danger of omitting such examination, and of relying upon König's tables or on earlier experiments by the same author, since the variations in the composition of the usual food materials may lead to serious errors.—W. G. M.

Protein Bodies [Edestin], Definite Compounds of. T. B. Osborne. J. Amer. Chem. Soc. 1899, **21**, [6], 486—493.

This paper contains a brief account of the author's investigation, which has led him to the conclusion that proteid substances as hitherto prepared are definite compounds of the proteid with common mineral acids, or contain such compounds.

A large number of proteid substances were prepared in as pure a state as possible, and, without exception, they were found to be acid to phenolphthalein, slightly acid or neutral to litmus, and decidedly alkaline to lacmoid.

In the case of edestin, the nature of the acids which enter into combination with the proteid have been more fully examined. When preparations containing compounds of edestin with acids are suspended in a little water and exactly neutralised by dilute potassium hydroxide solution with phenolphthaleïn as indicator, the edestin remains undissolved, and is apparently free from acid.

In order to dissolve 1 grm. of the isolated edestin, an addition of 0·7 c.c. of decinormal alkali or 1·4 c.c. of decinormal acid is required. Pure edestin is readily soluble in a 10 per cent. solution of sodium chloride, and the solution, when freshly prepared, is neutral to phenolphthaleïn, but alkaline to litmus, and strongly alkaline to lacmoid. On heating this solution to 99° C., the proteid is incompletely coagulated. On saturation with sodium chloride, it is slightly precipitated; more completely by saturation with magnesium sulphate; and completely by saturation with sodium sulphate at 34° C.

Edestin is one of several crystallised substances frequently termed plant-vitellin. It has been extracted from seeds of hemp, sunflower, and castor bean. It forms at least two hydrochlorides. The mono-hydrochloride is prepared by dissolving edestin, neutral to phenolphthaleïn, in a 10 per cent. solution of sodium chloride, and mixing the solution gradually with a similar quantity of brine containing 1 c.c. of decinormal acid for each grm. of edestin. On dialysing the clear solution, a crystalline deposit is obtained, which, when washed with water, leaves an insoluble residue of edestin monohydrochloride. This can be dissolved in a 10 per cent. solution of sodium chloride, and reprecipitated by an addition of water. When dissolved in brine, 1 grm. of the preparation is rendered neutral to phenolphthaleïn by 0·7 c.c. of decinormal alkali, and thus, if the molecular weight calculated for edestin (about 14,300) be correct, the compound consists of 1 mol. of proteid combined with 1 mol. of acid. On heating the brine from which the compound has been precipitated by an addition of water, the precipitate dissolves, and re-appears, on cooling, in octahedral crystals. A solution containing 5 per cent. of edestin monohydrochloride and 10 per cent. of sodium chloride becomes turbid at 95° C., and is coagulated at 99° C.

The dihydrochloride is obtained by treating edestin with insufficient dilute hydrochloric acid to dissolve it. The part dissolving consists of the dihydrochloride. This is soluble in pure water, but is precipitated by the addition of small quantities of alkali. It is insoluble in a 2 per cent. solution of sodium chloride, but readily dissolves in a 10 per cent. solution, from which it can be obtained in a crystalline form in the same way as the monohydrochloride.

A solution containing 10 per cent. of sodium chloride and 5 per cent. of edestin dihydrochloride becomes turbid at 90°, and at 91° gives a flocculent precipitate, which increases with the rise in temperature up to 99° C. On neutralising a pure aqueous solution of this compound with decinormal alkali, with phenolphthaleïn as indicator, the edestin separates out completely, and is then almost entirely soluble in 10 per cent. brine.

The author has also obtained indications of the existence of other compounds of edestin containing considerably more hydrochloric acid.—C. A. M.

Margarin, Detection of Yolk of Egg in. Mecke. Zeits. öffentl. Chem. **5**, 231; Chem. Centr. 1899, **2**, [5], 321.

See under XXIII., *page* 948.

PATENTS.

Milk, Sterilising and Preserving. Société "Le Lait," Paris. Eng. Pat. 19,705, Sept. 16, 1898 (France, Mar. 10, 1898).

According to the process claimed, milk is placed in a strong iron vessel, the interior of which is enamelled or tinned. This vessel is completely filled with milk and connected with a carbonic acid supply. On allowing a quantity of milk to flow out, carbonic acid enters. The vessel is then heated by a water-jacket to 60° to 65° C., and afterwards cooled in a refrigerator. Oxygen under pressure is then admitted, and the milk in the vessel is ready for storage.

An apparatus is also claimed by means of which the milk in the above vessel is transferred to smaller receptacles (such as siphons, &c.) for retail purposes. The milk is forced from the larger vessel into the smaller ones under oxygen pressure.—W. P. S.

Margarine, Producing or Treating. J. H. G. Neisse, Hamburg, and J. H. Boll, Altona, Germany. Eng. Pat. 4711, March 3, 1899.

Yolk of egg is emulsified with sugar, or is dissolved in salt and emulsified with sugar, and the mixture added to the milk with which the margarin is churned. Yolk of egg may also be mixed directly with the milk. It is stated that this treatment causes the margarin to assume a brown colour when used for cooking.—W. P. S.

Peptones and Albumoses, Synthetic Production of Compounds Resembling. L. Lilienfeld and T. Silberstein, Vienna. Eng. Pat. 16,965, Aug. 5, 1898.

See under XX., *page* 945.

Syrups for Use in Making Beverages or as Flavourings. F. M. and D. D. Spence, Manchester. Eng. Pat. 16,979, Aug. 6, 1898.

The improvements consist in removing, in the form of ice, the greater portion of the water of fruit juices, by subjecting the juices to a freezing temperature. The ice is then separated from the concentrated juice, and sugar is added to the latter to form a syrup for keeping.—W. P. S.

Food, Apparatus for Injecting Liquid, especially Pickling and other Preservative Liquids, into. C. Baum, Mannheim, Germany. Eng. Pat. 8057, April 17, 1899.

The preserving liquid is contained in a cylinder provided with a piston. On moving the piston by means of a screw shaft and crank handle, the liquid is forced into a perforated injecting needle connected to the end of the cylinder by means of a flexible tube, and so passed into the meat into which the needle has been inserted.—W.P. S.

Rendering Albuminoids of Meat Permanently Soluble. J. W. C. Hamilton, Liverpool, and J. A. Linley, Sydney, N.S.W. Eng. Pat. 11,763, June 6, 1899.

Meat fibrin is digested in a slightly alkaline solution at a temperature of 180° to 200° F. for about eight hours; trioxymethylene or formic aldehyde is then added to the extent of ½ per cent. by weight of the meat, and the heat is raised to 240° to 250° F. until the dissolved portion no longer coagulates on cooling. The solution is then neutralised, filtered, and evaporated to dryness.—W. P. S.

Meat, Preservation of. F. Cowin, Chicago, U.S.A. Eng. Pat. 12,992, June 22, 1899.

The meat to be preserved is dipped in a thick liquid extract, obtained by evaporating the "tank water" (after the removal of meat and bones) produced in "trying" lard. On drying, this forms a film over the surface of the meat.—W. P. S.

Preserving Perishable Food and other Materials against Infection, Atmospheric and other Influences; Process of. W. Lanwer, Bremerhaven, Germany, and E. Rüping, Bremerhaven. Eng. Pat. 13,744, July 3, 1899.

The article is first sterilised on the outside by immersion in boiling water, and is then dipped once or twice in a bath of liquid glue, gelatin, and dextrin. This covering is then hardened by dipping in a 5 per cent. solution of formic aldehyde and drying.

In the case of meat and fruits which contain much juice, a preliminary coat is applied to the same by dipping in a bath of "boiling paraffin stearin," and they are then covered with a coat of resin dissolved in alcohol. When this is dry, the outer glue coating is applied and hardened as above.—W. P. S.

Preserving Bread. H. A. Sévigné, Boston, U.S.A. Eng. Pat. 14,288, July 11, 1899.

The bread is taken hot from the oven, allowed to cool to a temperature of about 90° F., and is then wrapped in waxed or paraffined paper. The wax is melted at the places where the paper overlaps, thus sealing up the package. —W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Soil, Filtering Power of the, and the Conveyance of Bacteria by means of Subsoil Water. F. Abba, E. Orlandi, and A. Rondelli. Zeits. für Hyg. 1899, **31**, 66; Proc. Inst. Civil. Eng. 1899, **137**, [3], 20.

The authors were appointed to carry out bacteriological researches on the character of the soil above and on either side of the intake of the filter galleries connected with the waterworks of Valsangone, Italy. The principal matters investigated were the nature of the soil and its suitability for filtering purposes; the extent to which bacteria derived from the upper layers were capable of penetrating into the subsoil; and the effect of surface pollution upon the quality of the water entering the filter galleries. The micro-organism used in the experiments was the *bacillus prodigiosus*; and, in certain cases, the water employed, was intensely coloured either with Methyl-eosin or with Uranin, which had been found by means of previous tests to have no injurious effects upon the bacteria. The details of the experiments are set out in tables, and a plan is given to explain the relative positions of the experimental area, the filter galleries, and the testing stations.

It was found that, in one case, the *bacillus prodigiosus* penetrated through the soil above the right-hand filter gallery in 1 hr. 15 min., whilst it took seven hours to percolate to the left gallery. In another case the bacillus took, in both cases, seven hours to reach the filtering galleries. When coloured-water tests were employed, the *bacillus prodigiosus* took 42 hours and the colouring matter 75 hours to reach the gallery. It was also found that the test bacillus remained for two months in the soil and was then capable of further cultivation, and also that it was present in considerable numbers in the deeper layers of the subsoil. The *bacillus prodigiosus*, moreover, occurred two years later in the water-supply, which would seem to prove that it remained in the soil for an additional period of two years. The authors compare the results of their experiments with those of a similar kind undertaken in 1897 by Pfuhl (this Journal, 1898, 687), and claim priority for their researches.—A. S.

River Water, Pollution of, by Cyanide. Eng. and Mining J. 1899, **68**, [9], 251.

Owing to a complaint having been made as to the pollution of the Waiomo Stream, in the Hauraki Mining District, New Zealand, through the discharge of tailings and cyanide of potassium from the Monowai Gold Mining Company's battery and cyanide plant, three samples of the water were taken for the purpose of analysis. The samples were taken out of the stream about 300 yards below the place where the cyanide plant is situated: (1) when there was only little tailings and a soakage from the plant finding its way into the stream; (2) when a "settler" was discharged into the stream, and after mixing with the water; and (3) 20 minutes after a settler containing tailings treated by cyanide of potassium had been discharged into the stream, there being about three sluice heads of water running in the stream at the time. When the samples were taken the battery was not running, but the cyanide plant was working.

The Government analyst, after examining the samples, reported as follows:—

"No. 1 is clear, without any sedimentary matter. I did not find any trace of cyanogen in the poisonous form in this water.

"No. 2 is very turbid, and contains a good deal of silicious sand. This is of a pale green colour, owing to the presence of ferrocyanide of iron, a salt which is, however, quite innocuous to health. This water contains a minute trace of cyanogen in its poisonous form. This is either free or united with potash as cyanide.

"No. 3 is a slightly turbid water, containing a minute proportion of ferrocyanide of iron, but not of cyanogen in its poisonous form."—A. S.

Water and Sewage, Analysis of. Offic. Rept. Brit. Assoc. Committee, 1899.

The Committee appointed by the British Association to devise a system for the uniform record of the results of the chemical and bacteriological testing of waters and sewages have reported as follows:—"It is desirable that results of an analysis should be expressed in parts per 100,000 except in the case of dissolved gases, when these should be stated as cubic centimetres of gas at 0° C. and 760 mm. in one litre of water. This method of recording results is in accordance with that suggested by the Committee appointed in 1887 to confer with the Committee of the American Association for the Advancement of Science, with a view to forming a uniform system of recording the results of water analysis. It is suggested that in the case of all nitrogen compounds, the results be expressed as parts of nitrogen per 100,000, including the ammonia expelled on boiling with alkali permanganate, which should be termed albuminoid nitrogen. The nitrogen will, therefore, be returned as: (1.) Ammoniacal nitrogen from free and saline ammonia. (2.) Nitrous nitrogen from nitrites. (3.) Nitric nitrogen from nitrites. (4.) Organic nitrogen either by Kjeldahl or by combustion, but the process used should be stated. (5.) Albuminoid nitrogen. The total nitrogen of all kinds will be the sum of the first four determinations. The percentage of nitrogen oxidised —that is, the ratio of two and three to one and four—gives sometimes a useful measure of the stage of purification of a particular sample. The purification effected by a process will be measured by the amount of oxidised nitrogen as compared with the total amount of nitrogen existing in the crude sewage. In raw sewage and in effluents containing suspended matter, it is also desirable to determine how much of the organic nitrogen is presented in the suspended matter. In sampling, the bottles should be filled nearly completely with the liquid, only a small air bubble being allowed to remain in the neck of the bottle. The time at which a sample is drawn, as well as the time at which its analysis is begun, should be noted. An effluent should be drawn to correspond as nearly as possible with the original sewage, and both it and the sewage should be taken in quantities proportional to the rate of flow when that varies, *e.g.*, in the emptying of the filter-bed. In order to avoid the multiplication of analyses, the attendant at a sewage works (or any other person who draws the samples) might be provided with sets of 12 or 24 stoppered Winchester half-pint bottles, one of which should be filled every hour or every two hours; and on the label of each bottle the rate of flow at the time should be written. When the bottles reach the laboratory, quantities would be taken from each proportional to these rates of flow, and mixed together, by which means a fair average sample for the 24 hours would be obtained. A method of reporting bacterial results, including incubator tests, which is likely to be acceptable to all workers, has not yet been determined."

The Committee consists of Professor Ramsay (Chairman), Sir W. Crookes, Professors F. Clowes, Percy F. Frankland, and R. Boyce, and Dr. Rideal (Secretary).

Nitric Acid in Water, Detection of. R. Cimmino. Zeits. anal. Chem. 1899, **38**, [7], 429.

See under XXIII., *page* 946.

PATENTS.

Sterilising Water, Apparatus for. Maiche, Ltd., London. From L. Maiche, Paris. Eng. Pat. 19,782, Sept. 17, 1898.

In Eng. Pat. 5007 of 1897, apparatus is described for sterilising water by heat, the process being carried on in closed vessels, so that the water retains its dissolved gases. The present invention relates to an improved apparatus in which the water passes continuously through a heater connected with coils of pipes, so arranged that an interchange of heat takes place between the incoming and the outgoing water, the supply of water and of heat being controlled by an automatic regulator, which is the chief subject of the patent.—L. A.

Distributing Apparatus for Sewage Tanks and other Purposes. M. J. Adams, Leeds. Eng. Pat. 19,063, Sept. 7, 1898.

The object of the invention is to provide a simple means whereby the flow from a drain or pipe may be automatically diverted from one tank to another, and also for withdrawing the liquid from full tanks.

The flow of the pipe to the tanks is directed by means of a cylinder or drum, having liberty to turn on its axis, which is placed horizontal. In the outer circumference of this drum an exit opening is provided, and in one side of the drum, at its centre, an inlet is provided.

The sewage flows into the drum, and when the latter is in a certain position the liquid flows out of one orifice into a tank, and when the tank has filled, the liquid overflows into a small cistern and raises a float, which causes the drum to perform half a revolution and the liquid to flow from the second orifice into another tank. In the meantime, by the half revolution of the axis of the drum, a cam is caused to raise a valve, through which the liquid contents of the first tank discharge themselves. When the second tank has become full, the operations are reversed in a similar manner.—L. A.

Pneumatic Lifting Apparatus for Water, Sewage, and other Liquids, the Regulation of Flow of same, and their Partial Purification. J. Shone and E. Ault, Westminster, Middlesex. Eng. Pat. 20,125, Sept. 22, 1898.

The tube conveying compressed air to the lower end of the tube up which the liquid is raised terminates in a nozzle device, furnished with a narrow aperture or apertures, so constructed and arranged that the compressed air issuing therefrom in a constant stream blows the liquid into foam, and becomes very intimately mixed therewith. Besides being thereby enabled to do more work in lifting the liquid, it also has a greater purifying effect in those cases where an oxidising action is beneficial.—L. A.

Fish Offal, Stable, Town, and Slaughterhouse Refuse, and other Materials and Substances requiring similar Treatment, Machines for Drying. H. Winckler, London. Eng. Pat. 21,499, Oct. 12, 1898.

The material to be dried is placed in a large drum or cylinder fitted internally with revolving arms or beaters, and heated externally by waste gases from a furnace. Air heated by passing through tubes fixed in the furnace, is driven through the cylinder.—L. A.

Precipitated Sewage Sludge as Cement, Process for the Utilisation of. W. R. Hutton, jun., Whitenich, Lanarkshire. Eng. Pat. 20,620, Sept. 30, 1898.

See under IX., *page* 918.

(*C.*)—DISINFECTANTS.

PATENTS.

Formic Aldehyde, Disinfecting by Means of. A. Zimmermann, London. From The Chemische Fabrik auf Actien vormals E. Schering, Berlin. Eng. Pat. 23,057, Nov. 2, 1898.

The 40 per cent. commercial formic aldehyde solution is diluted with water, until the strength is reduced to about 8 per cent. This dilute solution can be evaporated into the air of a room without polymerisation taking place.—L. A.

Vapours, Reducing Suitable Substances [e.g. Camphor, Naphthalene, &c.] into, and Apparatus therefor. R. Fiedler, Berlin. Eng. Pat. 14,134, July 8, 1898.

The substances to be vaporised are placed in a suitable vessel, and exposed to the heat radiated from a heated metal or other body, the vapours produced, being carried up by a current of air (instead of steam) passed through the apparatus, and conveyed through a pipe or hose to the place where they are to be used, as for example, for furs in fur stores, for deodorising or preserving.—R. A.

XIX.—PAPER, PASTEBOARD, Etc.

Cellulose. G. Bumcke and R. Wolffenstein. Ber. 1899, **32**, [13], 2493—2507.

The only intermediate compounds between cellulose and its ultimate products of hydrolysis hitherto known are "oxycellulose" and "hydrocellulose." Neither of these are well characterised or of constant composition. In view of the contradictory accounts of these substances, the authors discard these names as those of definite compounds, and have re-opened the whole question. For the examination of "oxycellulose" they selected hydrogen peroxide as a typical and convenient oxidising agent. Pure filter-paper was allowed to remain in contact with hydrogen peroxide for several days; the maximum reaction occurred when cellulose was treated with double the quantity of a 50 per cent. solution of hydrogen peroxide for 60 days at the ordinary temperature, with the result that the fibres were broken down into a powder. The product was thoroughly washed and dried, and on analysis had a composition corresponding to $6(C_6H_{10}O_5) + H_2O$, though $8C_6$ aggregates would not be outside the limits of error. Analysis is not sufficiently delicate to indicate the nature of the reaction, but the authors state their full conviction that it is not a simple addition of oxygen to the cellulose molecule, but rather a hydrolytic dissociation or "inversion." They believe that the cellulose molecule is split into two halves, of an aldehydic or reducing character, a belief which seems to be based mainly on analogy to the inversion of cane sugar by hydrogen peroxide under the same conditions, and also on the fact that the same action occurs with weak (4 per cent.) solutions of hydrogen peroxide, which could not be expected to oxidise directly. The authors name this product (which would formerly be considered as an oxycellulose) *Hydralcellulose*, emphasising its hydrolytic production and its aldehydic properties. Hydralcellulose, $C_{36}H_{62}O_{31}$, bears the same relation to cellulose as glucose does to cane sugar; it gives no reaction with iodine, it reduces Fehling's solution and ammoniacal silver solution, it restores the colour to bleached rosaniline (Schiff's reagent), and combines with phenylhydrazine. It is probably present to a greater or less extent in all the "oxycelluloses" hitherto described, and is the constituent which characterises their properties. The hydrazone on analysis was found to contain 1·71 per cent. of nitrogen (average), as against the theoretical 2·6 per cent. required by the above formula. The absence of unaltered cellulose was proved by treating the hydrazone with soda; part of it was dissolved and reprecipitated by neutralisation and part remained insoluble but both portions contained identical proportions of nitrogen. One grm. of hydralcellulose reduces about 15 c.c. of Fehling's as compared with 186·6 c.c. for glucose; but Fehling's solution is not a delicate method for its estimation. When boiled with caustic soda (10 per cent. solution), hydralcellulose is split up into two parts, analogous to the decomposition of an aldehyde into an alcohol and an acid; one part (about two-thirds) is insoluble and has the characteristics of cellulose (alcohol); the other third is dissolved by the soda and reprecipitated on neutralising the filtrate; this is called by the authors *Acidcellulose* (acid); the decomposition also takes place slowly in the cold. Acidcellulose can also be prepared direct from cellulose by boiling it with 30 per cent. solution of caustic soda for one hour, repeating the operation with fresh soda until all the cellulose has been dissolved, then acidifying the dark brown solution (yield 39 per cent.). It is likewise formed when cellulose is dissolved by and then recovered from Schweizer's cuprammonium solvent. The action of this liquid being hydrolytic and not truly solvent, no true solvent of cellulose, as such, is yet known. Acidcellulose is non-reducing, gives no iodine reaction, is sufficiently acid to decolorise phenolphthalein, it is soluble in soda, but not in ammonia, and is reprecipitated on neutralisation. A marked characteristic is that in the moist state it dissolves readily in concentrated hydrochloric acid and is thrown down on dilution with water or addition of alkali. But if its solution in hydrochloric acid be warmed or allowed to stand for some time, the ease with which ultimate hydrolysis to its simplest factors occurs is remarkable and the solution becomes reducing, this hydrolysis taking place far more readily than with ordinary cellulose. If the precipitated acid-cellulose be dried, it is converted into the lactone corresponding to the formula, $C_{36}H_{60}O_{31}$, which is obtained as tough, horny flakes. Acidcelluloselactone is insoluble in soda and has lost the property of being easily hydrolysed by hydrochloric acid like acidcellulose.

The various substances, namely, hydralcellulose, acidcelluloselactone, derived from cellulose both by caustic soda and by Schweizer's reagent, and normal cellulose, were all separately nitrated by 1·48 nitric acid under identical conditions, the nitro compounds were purified, and each lot separated into a portion soluble in alcohol and another portion only soluble in acetone. Each portion was analysed, and the alcohol-soluble compounds were thoroughly characterised by explosion point, optical rotation, and molecular weight. The results showed that the nitro derivatives from all four sources were identical. Special attention was paid to the molecular weight determinations; these could only be made on the more soluble nitro products, and were taken by the boiling-point method of Sandsberger-Blasius with pure acetone as solvent. The results were fairly concordant, and indicated a molecular weight for the nitro derivatives, soluble in alcohol, of 1,350, corresponding to the C_{36} formula enunciated above for hydralcellulose. The authors then argue that, since hydralcellulose is proved to be a hydrolytic dissociation product of cellulose, and since normal cellulose gives a nitro compound of the same molecular weight as that yielded by hydral- and acidcellulose, therefore the action of nitric acid on normal cellulose is not one of simple nitration, but of hydrolysis first and then of nitration; thus what has hitherto been thought to be nitrocellulose is in reality *nitrohydrocellulose.* Assuming the hydrolytic derivatives of cellulose already described to possess one-half the molecular complexity of normal cellulose, the simplest formula for the latter will be $C_{72}H_{120}O_{60}$ or $(C_6H_{10}O_5)_{12}$.—J. F. B.

Cellulose and Starch. Z. H. Skraup. Ber. 1899, **32**, [13], 2413—2414.

It is a general rule that on acetylation of cellulose or starch with mixtures of acetic anhydride and sulphuric acid, low temperature and little acid give products of greater complexity than more severe conditions of acetylation. For instance, on the gentle acetylation of starch, an acetyl derivative is obtained, which on saponification yields a substance resembling soluble starch, giving a blue iodine reaction, whilst more energetic acetylation yields products which reduce Fehling's solution and give no colour reaction with iodine. The author found it possible to obtain from cellulose, under certain conditions of acetylation, a substance crystallising in long needles from ethyl acetate or alcohol, melting at 228° C. The same substance had apparently been described some time ago by Franchimont as an endeka-acetylated tri-glucose. But the author finds, by molecular weight determinations and analysis, that it is an acetylated hexose containing certainly five, possibly seven, acetyl groups; analysis does not show whether it is a pentacetyl hexose or a heptacetyl derivative of a heptahydric alcohol. It is certainly not a glucose derivative, and the product of saponification yields with phenylhydrazine, not an osazone, but a hydrazone m.p. 194, somewhat resembling that of mannose.

Finally, it is remarked that by carefully regulated gentle acetylation of cellulose and starch, products can be obtained containing more acetyl than is theoretically possible according to the generally accepted formulæ.—J. F. B.

Paper - Testing. W. Herzberg. Mittheilungen aus d. königlich. Techn. Versuchs. 1899, **17**, [3], 119—120.

A brief account is given of the results of the examination of two samples of paper submitted to the department for paper-testing. In one case it was stated that the paper was not the same as the sample by which it had been bought. This was confirmed by the analyses of specimens of the two, which gave the following results:—

——	Mean Length of Tearing.	Mean Extension.	Composition.	Ash.	Sizing.
	M.	Per Cent.		Per Cent.	
Original sample	5,375	4·3	Wood cellulose with a small amount of straw cellulose.	1·4	Fixed
Delivery	1,900	2·1	Wood cellulose	10	Not fixed

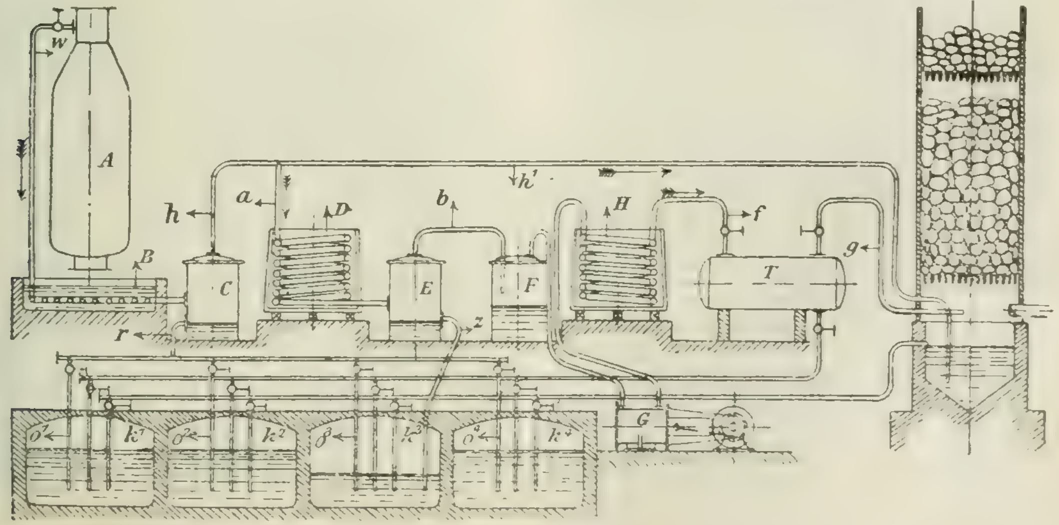
On testing the bulk sample with ferric chloride by Post's method, the drops penetrated through the paper, and were plainly visible at the back.

In the second case a firm of woollen-goods merchants had purchased a quantity of paper for packing which was described as "Ia Manilla free from added cellulose." On microscopical examination this was found to contain 55 per cent. of Manilla hemp and 45 per cent. of wood cellulose.

—C. A. M.

Sulphurous Acid from the Waste Gases of the Sulphite Digester, Recovery of. Türk. French Pat. 288,028, April 20, 1899, through Papier Zeit. 1899, **24**, [78], 3035.

The object of the apparatus is to treat the mixture of steam and sulphur dioxide gas given off from the sulphite digester by repeated cooling and complete drying over sulphuric acid, finally liquefying the gas by pressure. The waste gases leave the digester A by the pipe W, and pass into the cooling



worm B. The greater part of the steam is condensed here, and the water, containing 4 to 5 per cent. of sulphurous acid, flows by way of the separator C into the sulphite liquor tanks k_1—k_1, through the pipes *r*, o_1—o_1. The excess of sulphur dioxide gas passes out of the separator through the pipes *h* and *a*, and the cooling worm D into a second separator E, which drains off more of the condensed water and acid by the pipe *z*. The gas is then finally dried by being pumped through the vessel F containing sulphuric acid, and compressed by the pump G to a pressure of 3 to 5 atmospheres. The temperature of the gas is raised by the compression, and must again be reduced in the cooling worm H. By this means the dry sulphur dioxide gas is liquefied and flows into the container T, whilst the residual air is let off through the pipe *g* under the hearth of the absorption tower. When it is required to let down the pressure of the digester at the end of the boiling, the gases escape too quickly to be dealt with in the above manner; in this case they are allowed to travel down the pipe h_1, directly into a small sulphite liquor tank situated beneath the absorption tower. When the quantity of gas evolved from the digester is only small, the working of the compressor causes a vacuum in the liquor tanks, and the liquor flows back into the separator C, sounding an alarm, so that the valves may be closed or the compressor stopped.—J. F. B.

PATENTS.

Paper Pulp from the Root Refuse of the Common Reed (Phragmites communis). A. von Feszty, Hungary. Eng. Pat. 7438, April 8, 1899.

The claim covers the process for manufacturing paper pulp from the root fibres of the common reed (*Phragmites communis*) by boiling the previously washed mass of tangled root fibres at the ordinary atmospheric pressure, or at an increased pressure (2 to 6 atmospheres) with a weak solution of hydrate of lime, or of a caustic alkali, or of an alkali carbonate, the boiled mass being afterwards washed, and, if desired, subjected to a bleaching operation.—J. F. B.

Flax Pulp, Manufacture of. F. Hickman, New Jersey, U.S.A., and The French-Hickman Flax Fibre Co., Ltd., London. Eng. Pat. 12,405, June 14, 1899,

A paper pulp, consisting of the bast fibres and other cellulosic tissue of the flax plant, or straw freed from fats, waxes, and other encrusting material, is claimed. Also the process for producing the same by dissolving sulphur in a hot solution of caustic soda (0·5—5 parts of sulphur to 99·5—95 parts of soda) and then cooking the flax straw in the liquor thus prepared. The strength of the lye is not stated, but the material is preferably boiled with it in a digester at 70—95 lb. per sq. in. pressure for about 4½ hours.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Bromine [also Iodine and Volat. Liquids] in Water, Solubility of. L. W. Winkler. Chem. Zeit. 1899, **23**, [67], 687.

The author has estimated the solubility in water of bromine, both as liquid and as vapour. The former was accomplished by means of a specially-constructed stoppered bottle in which bromine first carefully purified, was shaken up with water. Samples of the saturated water were taken out with a capillary siphon, weighed and run into a concentrated solution of potassium iodide. The iodine was titrated with sodium thiosulphate, and the bromine calculated therefrom. The average results were as follows:—

Temperature, ° C.	100 parts of Water dissolve	1 part of Bromine dissolves in
	Parts of Bromine.	Parts of Water.
0·00	4·167	24·00
10·34	3·740	26·74
19·96	3·578	27·94
30·17	3·437	29·10
40·03	3·446	29·02
49·85	3·522	28·39

Considerably less bromine is dissolved at 0°, if bromine hydrate be present, in which case the solution must be looked upon as one of bromine hydrate in water.

Temperature, ° C.	100 parts of Water dissolve	1 part of Bromine dissolves in
	Parts of Bromine.	Parts of Water.
0·00	2·359	42·39
5·12	3·808	26·26

Another special apparatus was used in determining the solubility of bromine vapour. Bromine water was shaken up for some time. Thus, vapours were evolved. The amount of bromine vapours over the bromine water, and also the quantity of bromine remaining in solution, was estimated, and from these figures and from the pressure was calculated the absorption coefficient, indicating how many volumes of vapour (at 0—760 mm. pressure) were dissolved in 1 volume of water under the pressure of 760 mm.

From a great number of experiments, the author concluded that bromine vapour dissolves in water, following Dalton and Henry's law, in proportion to the pressure.

A table is given stating the absorption coefficients for every two degrees.

In a former communication (Zeits. physik. Chem. 1892, **11**, 171) the author proved that the formula—

$$\frac{\beta_o - \beta t}{\beta_o} = \frac{\mu_o - \mu_t}{\mu_o} \cdot \frac{\sqrt[3]{m}}{\kappa}$$

expresses the law which the absorption coefficients of diatomic gases follow. In this formula β_o is the absorption coefficient of the gas at 0°, β_t at t°, μ_o and μ_t the inner friction at 0 and t°, m the molecular weight. κ, from the coefficients at 0°—20° C., = on the average, 3·785 for hydrogen, oxygen, nitrogen, carbon monoxide, and nitric oxide. From the absorption coefficients of the bromine vapour at 0° and 20°, κ is calculated at 3·673, which shows sufficiently that bromine follows the same law.

From a comparison of the absorption coefficients of bromine as liquid and vapour, it will be seen that, of the former, only the amount corresponding with the absorption coefficient of the bromine vapour and the tension of the liquid bromine, will dissolve in water. Hence, if b be the quantity of liquid bromine which is dissolved by 1 grm. of water, β the absorption coefficient of bromine vapour, v the specific volume of water at the same temperature, the tension p of the liquid bromine for this temperature may be calculated from the equation—

$$p = \frac{b.\,760}{\beta.\,v.\,0{\cdot}0071426}$$

0·0071426 being the weight of 1 c.c. of bromine vapour at 0° and 760 mm. pressure.

In the following table, which gives the results of these calculations, the "tensions found" are interpolated according to Ramsay and Young:—

Temperature.	Tension calculated.	Tension found.
0° C.	Mm.	Mm.
0·00	73·3	67
10·34	115·3	112
19·96	178·4	175
30·17	269·7	268
40·03	387·1	391
49·85	569·7	559

The conclusion must be drawn from these experiments that bromine in the liquid state, is insoluble in water, only its vapour being soluble. Iodine also will only dissolve when in the form of vapour, and its solubility in water is small, since its tension at ordinary temperatures is low. It seems as if the dissolving process of two volatile liquids represents a process of absorption. If ether be shaken with water, ether is dissolved in water and water in ether, each according to their absorption coefficients and tension. In the case of alcohol and water, which are miscible in all proportions, the absorption coefficient is infinitely high.

Another result of these experiments is, that the absorption coefficient may now be calculated of volatile liquids, little soluble in water, if solubility in water and tension are taken into consideration.—S. K.

Alkaloids and their Salts, Solubility of, in Chloral Hydrate. E. Schaer. Zeits. Anal. Chem. 1899, **38**, [8], 469—472.

An aqueous chloral hydrate solution is the only liquid in which the alkaloids and their salts are soluble to the same extent. The use of this solvent for the extraction of alkaloids from the plants in which they are found is especially valuable when the alkaloids are surrounded by starch, or accompanied by large quantities of resins, essential oils, gums, &c., all of which substances are readily dissolved by strong chloral hydrate solutions.

The endosperm of nux vomica contains a mucilage which swells in chloral hydrate solution, and causes difficulties in the extraction of the alkaloids by this solvent. In cases where the alkaloids are surrounded by fats and waxes, the use of a strong alcoholic solution of chloral alcoholate is recommended. No advantage is gained in the presence of substances similar to caoutchouc and gutta-percha, which are insoluble in this medium. The chloral hydrate solutions of the free bases frequently decompose on warming, with production of chloroform and alkaloid formate. (See also Zeits. Anal. Chem. 1899, [3], and 1894, 193.)—A. C. W.

Russian Turpentine. A. L. Petroff, Russian Physico Chemical Society. Chem. Zeit. 1899, **23**, [64], 659.

Turpentine resin obtained from pines growing in the province of Perm gave, on distillation with steam, about 19 per cent. of oil of turpentine, which is as good a yield as that obtained from American or French pine resins. The quality of the balsam obtained from the same source was found to be fully equal to the Canadian product.
—G. H. B.

Volatile Oils and their Constituents: Solubility in Aqueous Solution of Sodium Salicylate. M. Duyk. Bull. de la Soc. Royal de Pharm. de Bruxelles, **43**, 225—240.

Since many of the alcohols, aldehydes, ketones, and phenols, which are constituents of essential oils, are readily soluble in a 1 : 1 saturated aqueous solution of sodium salicylate having the sp. gr. 1·240, whilst terpenes, esters, and sesquiterpenes are generally insoluble in that medium, it is proposed to use this solvent to remove the soluble bodies for technical purposes, or to employ it for quantitative determinations in the examination of the oils in which they occur. The bodies readily dissolved out by the salicylate solution include the alcohols, geraniol, linalool, citronellol, borneol; benzoic, salicylic, anisic, and cinnamic aldehydes; also citral, citronellal, vanillin, and heliotropin; carvone, methylheptenone, pulegone, menthone, thujone; cineol, eugenol, thymol, and carvacrol. Camphor and menthol dissolve less readily. Santalol, anethol, safrol, apiol, esters, and terpenes are practically insoluble. To liberate the bodies removed by the solvent, it is merely necessary to dilute the separated solution with water, aiding the aggregation of the oil with a gentle heat; if the liberated substances be not quite free from accompanying terpenes or other impurities, re-solution and re-dilution is necessary to obtain them in a state of purity. The method is applicable for the separation, for instance, of carvone from caraway oil, or of cineol from eucalyptus or from cajuput oil.

For the quantitative determination of the amount of soluble alcohols, ketones, or phenols in a specimen of oil, 1 c.c. is taken and shaken with 4 c.c. of the sodium salicylate solution in a small burette graduated in $\frac{1}{20}$ c.c. After standing, the insoluble portion rises to the surface; when separation is complete, the lower layer is removed, a fresh quantity of the solvent added, with agitation, the volume of separated insoluble bodies being finally read off. With these oils which contain esters, such as bergamot, two determinations by the process are necessary—one before and one after saponification. The observed difference in the amount of soluble bodies in the two determinations will indicate the quantity of the alcohol present in the form of ester in the original oil. Details of the results obtained with various oils are being published.—J. O. B.

Bergamot Oil, Purity of. A. Soldani and E. Berté. Zeits. für Untersuch. der Nahrungs- und Genussmittel, **2**, [6], 537.

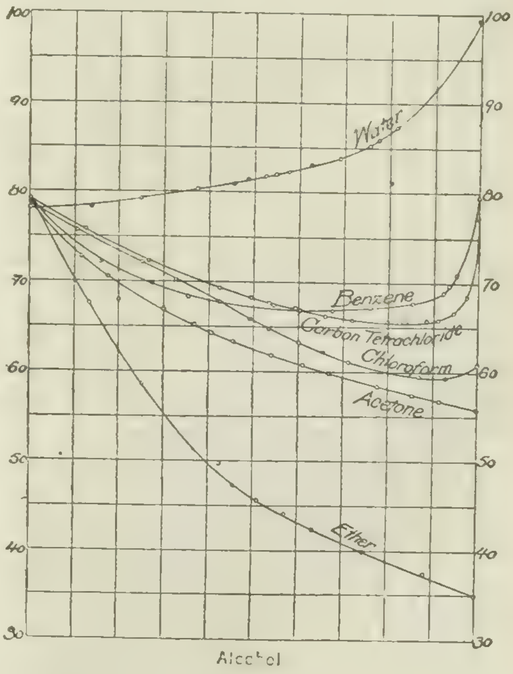
When pure bergamot oil is fractionated, the dextro-rotation of the distillate gradually falls. until, when half the oil has distilled over, it becomes negative. In a bergamot oil adulterated with turpentine, the dextro-rotation of the first fraction is less than that of the pure oil, whilst that of the second fraction is the same as that of normal oil. If from 15 c.c. of pure oil 10 c.c. be distilled off, the residue will be slightly lævogyrate, but if the sample contain 5 or even 2·5 per cent. of lemon oil, or the same quantity of turpentine, the rotation of the residue will be dextrogyrate.

When pure bergamot oil is fractionated under a reduced pressure of 15 to 20 mm., the first third which distils will have a rotation + 35° to + 45°, whilst that of the residual two-thirds will be under + 1°. If the rotation of the first fraction be higher than + 45°, the presence of lemon oil is established. If the rotation of the residue be over + 2° while that of the distillate is below + 40°, both lemon oil and turpentine have been added.—J. O. B.

Boiling Points of Mixed Liquids. J. K. Haywood. J. Phys. Chem. 1899, **3**, [5], 317—327.

Previous investigations on the distillation of perfectly miscible liquids have been carried out by measuring the vapour pressure with varying composition, the temperature being kept constant. (See Konowaloff, Wied. Ann. 1881, **14**, 34; and Roscoe, Annalen, 1859, **112**, 327, and 1860, **116**, 203.) The author considered it would be more profitable to adopt the procedure more nearly like the conditions of actual practice, and he therefore examined the variation of the boiling point with composition under constant pressure. This method had previously been adopted by Thayer (J. Phys. Chem. 1898, **2**, 382; 1899, **3**, 36). The apparatus used was essentially that of Orndorff and Cameron (Amer. Chem. J. 1895, **17**, 57). The thermometer, which had previously been carefully calibrated, was graduated to $\frac{1}{10}$th of a degree; all the readings given are uncorrected. The materials employed were all

Fig. 1.



carefully purified, and in every case, before using, distilled through a high-column still, the first and last portions being discarded. All the determinations were made at the prevailing atmospheric pressure; in no case was the variation large enough to seriously affect the value of the results.

The mixtures employed were of alcohol with water, ether, and with carbon tetrachloride: chloroform with carbon tetrachloride and with methyl alcohol; and acetone with water, methyl alcohol, ether, and with carbon tetrachloride. The results are set out in a series of tables, in which are given the composition of the mixture, the temperature at which it boils, and the atmospheric pressure at the time of the experiment; but they may be seen more clearly by reference to the diagrams, in which, for purposes of comparison, the results of Thayer are included.

In Fig. 1 the results for mixtures of the various liquids with alcohol are given. It may be noted that the slight waviness observed by Thayer at the alcohol end of the curve for chloroform does not appear in the case of carbon tetrachloride, and it seems evident that if both curves had been determined at the same pressure, the one from chloroform would rise slightly, then fall again until at about a composition of 35 per cent. of chloroform, and would then cut the curve for carbon tetrachloride. The fact of two of the boiling points in the case of the ether mixture being obviously too high is due probably to some of the material being lost by the violent ebullition resulting from adding the ether to the hot alcoholic solution.

In Fig. 2 the results for the mixtures with chloroform are given. The waviness shown by the curves appears to be a general characteristic for curves corresponding to chloroform solutions.

Fig. 2.

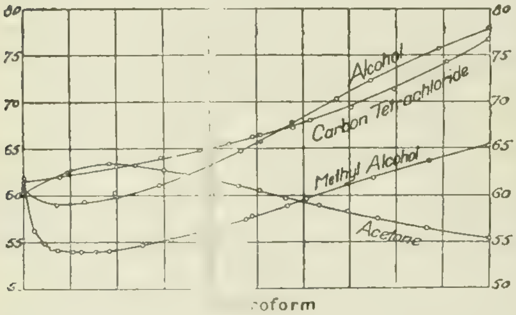


Fig. 3 illustrates the results obtained for mixtures with acetone. If the pressures had been the same, the alcohol and water curves would probably have intersected in two points.

From the results of the investigation, the author has drawn the following conclusions:—

(1.) All mixtures of the following pairs of liquids boil at temperatures between the boiling points of the constituents: alcohol-water, alcohol-ether, chloroform-carbon tetrachloride, acetone-water, and acetone-ether.

(2.) A solution containing 17·5 per cent. of alcohol in carbon tetrachloride distils without change at 65°·5 C. approximately, under 768·4 mm. pressure.

(3.) A solution containing 12·5 per cent. of methyl alcohol in chloroform distils without change at 54° C. approximately, under 770·2 mm. pressure.

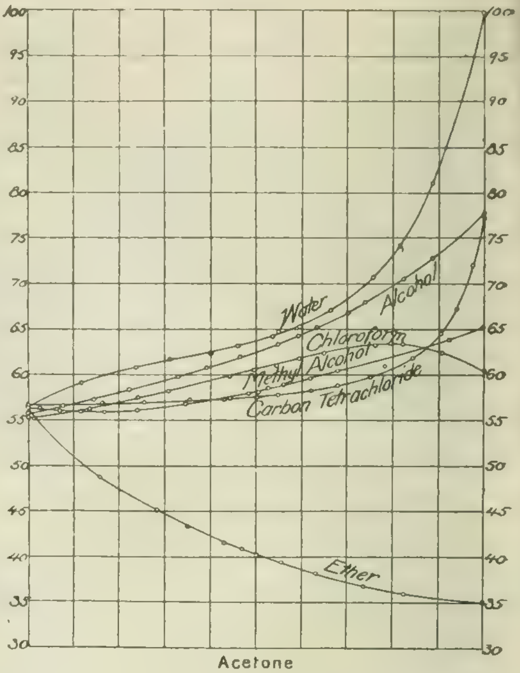
(4.) A solution containing 12—13 per cent. of methyl alcohol in acetone distils without change at 55°·9 C. approximately, under 764·8 mm. pressure.

(5.) A solution containing 15—20 per cent. of carbon tetrachloride in acetone distils without change at a temperature but 0·05° below that of the pure acetone, and all mixtures containing more than 40 per cent. of acetone boil within 1° of the boiling point of the acetone itself.

(6.) The close proximity of the boiling points of the constituents appears to be a favourable condition for the existence of a maximum or a minimum point on the boiling-point curve. Similarity of constitution, however, seems to be a strongly modifying condition.

(7.) In general, one constituent remaining the same, the mixtures with substances of similar chemical constitution yield similar boiling-point curves. One well-marked exception appears: carbon tetrachloride and chloroform in acetone.—A. S.

Fig. 3.



Aldehydes in Alcohols, New Reactions for the Detection of. C. Istrati. Zeits. anal. Chem. 1899, **38**, [8], 517.

See under XXIII., *page* 947.

Pilocarpine, Assay of Preparations containing; and the Characters of Pilocarpine Nitrate and Hydrochloride. H. A. D. Jowett. The Wellcome Research Laboratory Report, No. 6, 1—7.

See under XXIII., *page* 952.

Chloral Hydrate, Official Test for. F. H. Alcock and T. H. Thomas. Pharm. J. 1899, **63**, [1524], 236. Also F. P. Sargeant. *Ibid.*

See under XXIII., *page* 952.

Morphine and its Derivatives, Detection of. R. Kobert. Sonderabdruck. aus Apoth. Zeit. **14**, [37]. Chem. Centr. 1899, **2**, [2], 149.

See under XXIII., *page* 948.

Oil of Turpentine for Mineral Oils, Preliminary Examination of, for Custom House Authorities. C. Schreiber and F. Zetzsche. Chem. Zeit. 1899, **23**, [67], 686.

See under XXIII., *page* 949.

Santonin, Quantitative Determination of. J. Katz. Arch. Pharm. 1899, **237**, 245.

See under XXIII., *page* 952.

Vanillin in Vanilla, Determination of the. W. Busse, Arb. Kaiserl. Ges. 1898, **15**, 1—13. Through Zeits. für Untersuch. der Nahrungs- und Genussmittel, **2**, [6], 519.

See under XXIII., *page* 952.

PATENTS.

Peptones and Albumoses, Process for the Synthetic Production of Compounds resembling. L. Lilienfeld and F. Silberstein, Vienna. Eng. Pat. 16,965, Aug. 5, 1898.

The process claimed consists in condensing a phenol or mixture of phenols with an amido acid or mixture of amido acids by means of phosphorus oxychloride, pentachloride, sulphochloride, pentoxide, or metaphosphoric acid. The products may be separated from the reaction mixture and purified by known methods applicable to the natural peptones. The products themselves are also claimed. —A. C. W.

New Imido Compounds containing Halogen. H. E. Newton, London. From Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 20,801, Oct. 3, 1898.

A process is claimed for the production of halogen derivatives of imides (phthalimide, succinimide, &c.), in which the halogen substitutes the hydrogen of the imide group. The process consists in acting upon the imide salt with the halogen, the reaction may be carried out in aqueous solution at 0° C., or in indifferent solvents at a higher temperature. To prevent the formation of double compounds of the iodo-derivatives and potassium iodide, iodine chloride or bromide may be employed instead of iodine. The compounds are claimed as new articles of manufacture, and also their use is claimed for medicinal purposes (antiseptics). —A. C. W.

Substance [from Suprarenal Capsules] for raising the Pressure of the Blood. O. Imray, London. From Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 21,756, Oct. 15, 1898.

The process claimed consists in extracting suprarenal capsules with a solution of zinc sulphate, precipitating a zinc compound by ammonia, decomposing this compound by an acid in alcoholic solution, reducing the acid solution (with zinc dust), freeing from zinc sulphate by alcohol and ether, and evaporating. The product is also claimed. —A. C. W.

Amido-acylamidocarboxylic Acid Esters. O. Imray, London. From Farbwerke vormals Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 22,106, Oct. 20, 1898.

The manufacture of glycocoll derivatives of the esters of aromatic amido-carboxylic acids is claimed, by processes which consist in allowing primary or secondary bases to act upon the chloracyl derivatives of these esters (obtained by the action of chloracetyl chloride upon the esters), or in acting upon the aromatic amido-carboxylic acids with chloracetyl chloride, combining the halogen acylamido derivative produced, with a primary or secondary base and then esterifying the product.—A. C. W.

Ionone from Citral and Acetone, and Cyclocitral as Intermediate Product. A. Strebel, Frankfort a/M., Germany. Eng. Pat. 23,254, Nov. 4, 1898.

The claims are for a process for the manufacture of ionone and its various stages. The complete process is as follows:—Citral is condensed with cyanacetic acid forming citralidene - cyanacetic acid, which is converted into the cyclic isomeride by boiling with dilute sulphuric acid (Eng. Pat. 22,114, 1893). This is converted into crude cyclocitral by dissolving in a little caustic alkali and blowing in a current of steam whilst caustic potash is being slowly added, or by boiling with water and xylene and fractionating the xylene solution. In both cases a small quantity of lead peroxide or other similar oxidising agent may be added. The cyclocitral is then condensed with acetone by means of alkaline reagents (sodium ethylate), the product is neutralised with tartaric or other acid, the ionone distilled off in steam and fractionated. Ionone so prepared is rich in β-ionone, and when treated with semicarbazide hydrochloride and sodium acetate gives a considerable proportion of the semicarbazone melting at 148° C.—A. C. W.

Basic Phenol Ethers, Manufacture of. O. Imray, London. From Farbwerke vormals Meister, Lucius, und Brüning, Hoechst a/M., Germany. Eng. Pat. 23,435, Nov. 7, 1898.

If the chloracetic esters of phenols be treated with secondary amines, basic compounds are produced, which form salts soluble in water. These are non-poisonous and antiseptic; they may be called glycocollphenol esters. The process and its products are claimed.—A. C. W.

Erratum.—This Journal, 1899, page 782, col. 1: 5 lines from bottom, in equation for "$\frac{1}{6}$IOsNa" read "$\frac{1}{6}$ IO_3Na."

XXI.—PHOTOGRAPHY.

Copal Lac for Negatives, Epichlorhydrin for the Preparation of. E. Valenta. Phot. Corr. 1899, 2; Chem. Centr. 1899, **2**, [4], 277.

It is stated that both epichlorhydrin and dichlorhydrin are very useful solvents for many resins, and that the varnishes produced, possess properties which indicate their suitability for photographic and other purposes. The following recipe is given:—20 grms. of Manilla copal are dissolved on the water bath in 70 grms. of epichlorhydrin, 100 c.c. of alcohol are added, and the solution filtered. For diluting purposes a mixture of 1 part of epichlorhydrin with 5 parts of alcohol, is used. It is stated as a particular advantage that the dried film can be satisfactorily retouched.—A. S.

Photographing on Glassware. Diamant, **21**, [18], 285.

Like porcelain, glassware may be decorated photographically by coating it with a solution of chrome-gelatin, superposing a positive, and printing by exposure to light. When the print is finished, the picture is developed and brought up into relief by dusting it over with finely-powdered black flux, which is then fixed by firing; painting in colours, also fired on, may be subsequently carried out. Any ordinary print on clear paper can also be transferred to glass by the same means, provided the paper be rendered transparent by impregnation with paraffin, poppy oil, castor oil, or petroleum spirit. To counteract the lightening of the shadows by this treatment, a sheet of ground blue-green glass should be laid over the positive when printing.

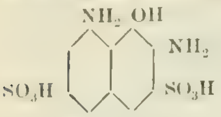
Attempts at polychrome printing by successive transfer of the different sections of a coloured picture—each colour by itself—and dusting each in turn with suitably coloured fluxes, have been made, but without much success, owing to the unfavourable reaction of the chrome gelatin (when fired) on some of the pigments employed.—C. S.

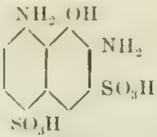
PATENTS.

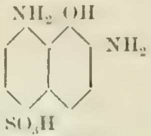
Photographic Developers. C. D. Abel, London. From The Actiengesellschaft für Anilin Fabrikation, Berlin, Germany. Eng. Pat. 21,595, Oct. 13, 1898.

The patentees have discovered that naphthalene derivatives containing in one nucleus the amido- and hydroxy-groups in the same position which these groups occupy in the Eikonogen (α_1-amido-β_{-1}-hydroxyl-β_3-sulphonic acid) and containing also another active group in the second nucleus, are developers like Eikonogen itself (this Journal, 1890, 102), but are distinguished from it by certain valuable properties. The somewhat slow action and want of density shown by the developers described in Eng. Pat. 5207, 1889, and 25,002, 1893 (this Journal, 1894, 1219), when used with sodium sulphite alone, can thus be improved by introducing into their second nucleus another amido group. Compounds of such constitution are the diamido-naphthol sulphonic acids obtained by reducing the azo-dyestuffs derived from α_1-amido-α_4-naphthol $\beta_2\beta_3$ disulphonic acid (acid H), α_1-amido-α_4-naphthol-$c_2\beta_3$-disulphonic acid (acid K), or α_1-amido-α_4-naphthol-c_2-monosulphonic acid (acid S).

These new diamidonaphtholsulphonic acids are represented by the following formulæ :—


(from acid H)


(from acid K)


(from acid S)

—S. K.

Photographic Printing. H. H. Lake, London. Eng. Pat. 10,783, May 23, 1899. From R. B. West, Newhaven, U.S. America.

For sensitizing paper, a composition is patented, consisting of a soluble nitro-prusside, ammonia citrate of iron and water. Prints made on paper thus sensitized, are developed in a bath containing acetate of lead.—S. K.

XXII.—EXPLOSIVES, MATCHES, Etc.

Acetylene, Metallic Derivatives of. Berthelot and Delépine. Comptes Rend. 1899, **129**, [7], 361.

See under XXIV., *page* 953.

Cellulose. G. Bumcke and R. Wolffenstein. Ber. 1899, **32**, [13], 2493.

See under XIX., *page* 940.

PATENTS.

Explosives, Manufacture of. J. Okell, Maida Hill. Eng. Pat. 18,935, Sept. 5, 1898.

Alder wood is steamed, cut into shavings, and then purified by treatment with alkali and bleaching powder, and the cellulose so obtained is nitrated in a mixed acid for two hours, then washed and soaked in a solution of soda. For making powder, 100 parts of this nitrated cellulose are mixed with 78 parts of ether, 12 parts of alcohol and 10 parts of acetone, and the paste rolled and cut into grains. These grains are then nitrated again for 10 hours, and, after washing and soaking in a solution of ammonia, are placed in a boiling solution of barium nitrate and potassium nitrate, and afterwards mixed with collodion solution, compressed into cakes, broken up into grains and polished with paraffin. It is claimed that by the process a powder is produced with a highly explosive core, a less explosive inner coating, and a waterproof and slowly-burning outer coating.—G. W. McD.

Matches without Yellow Phosphorus, capable of being Struck anywhere. S. A. Rosenthal, London, and S. J. von Romocki, London. Eng. Pat. 19,039, Sept. 7, 1898.

Match heads are first formed with a paste similar to that used for safety matches, consisting of sulphide of antimony (1 part), chlorate of potash (10 parts), umber (1·5 parts), and gum arabic (1·5 parts). The heads so formed are then dipped in a mixture composed as follows:—Sulphide of antimony (1 part), chlorate of potash (3 parts), red phosphorus (1 part), and powdered glass (4 parts), and this latter coating is capable of being ignited by friction.

—G. W. McD.

Matches, Impts, in or relating to. C. Kastner, Vienna. Eng. Pat. 20,449, Sept. 27, 1898.

The composition of the igniting paste is given as follows :—

	Parts.
Bichromate of potash	0·65
Oxide of copper	0·15
Solution of gum arabic	2·55
Sulphur	0·1
Amorphous phosphorus	0·425
Powdered glass	1·4
Flour	2·55
Mineral colouring	0·1
Brickdust	1·15
Water	7·3
Chlorate of potash	5·67

—G. W. McD.

Ordnance, Explosive Charges for. A. T. Dawson, Westminster, and J. Karstairs, Crayford. Eng. Pat. 22,438, Oct. 25, 1898.

Discs are formed, with a diameter nearly equal to the bore of the charge chamber, consisting of an inner disc made of a powerful explosive, entirely enclosed in an outer part composed of a less powerful explosive. When the charge is ignited, the external portions of the disc are first consumed, and then the more powerful internal explosive burns, giving a final impulse to the projectile as it is leaving the bore.

—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

New Indicator. A. E. Sunderland and A. E. Rhodes. J. Soc. Dyers and Colorists, 1899, **15**, [9], 206.

The authors recommend the diazo compound of paranitraniline and propylmetacresol as an indicator for use in acidimetry and alkalimetry. This compound forms a powder insoluble in water, but soluble in a mixture of water with 30 per cent. and upwards of alcohol. It is said to have the constitution—

$$C_6H_5.N{:}N.C_6H_2.CH_3(OH)CH(CH_3)_2.CH_3{:}OH{:}CH(CH_3)_2 = 1{:}3{:}4,$$

and is especially sensitive to alkalis. It can replace lacmoid for the estimation of the hardness of waters by the alkalimetry test. It is far more sensitive than phenolphthaleïn, is equal to Methyl Orange for the estimation of ammonia, and can serve as an indicator in the titration of organic acids. Like phenolphthaleïn, however, it is sensitive to carbon dioxide and carbonates. It is said to surpass other indicators in sharpness of colour change (pink when alkaline, to faint yellowish, when acid), and sensibility.—A. S.

PATENT.

Colour Intensity of Coloured Liquids and of Transparent Solid Matter, Apparatus for Measuring the. A. C. P. Le Docte, Gembloux, Belgium. Eng. Pat. 20,667, Sept. 30, 1898.

Two tubes, one of which contains the substance to be compared, whilst the other contains a standard liquid, are enclosed in a box, which serves to protect them from accidental illumination. An illuminating chamber, situated below the box, is provided with means for projecting rays of light through the tubes, the light, after passing through the tubes, being deflected into a single eye-piece by mirrors or by two total-reflection prisms. The tube containing the standard liquid is connected to a reservoir, which, by means of a rack and pinion adjustment, &c., is adapted to vary the level of the liquid in the standard tube. Further details and modifications adapted to facilitate the reading of the instrument, &c. are described and claimed.—R. A.

INORGANIC CHEMISTRY.—QUALITATIVE.

Nitric Acid in Water, Detection of. R. Cimmino. Zeits. anal. Chem. 1899, **38**, [7], 429—431.

One c.c. of the water is treated with 3—4 drops of a solution of diphenylamine and sulphuric acid in 5 per cent. hydrochloric acid; 2 c.c. of concentrated sulphuric acid are added, and the mixture well shaken. A blue coloration is produced even with one part of nitric acid per million. No other impurity gives this reaction.—T. E.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Crude Silicon, Analysis of. H. Bornträger. Zeits. anal. Chem. 1899, **38**, [6], 350—351.

Ten grms. of potassium hydroxide are dissolved in about 100 c.c. of water in a capacious silver dish. After warming, about 0·5 grm. of the finely-powdered crude silicon is sprinkled in, a little at a time. The silicon dissolves with gentle evolution of hydrogen, leaving the impurities, alumina, oxide of iron, and ferro-silicon. The solution is then diluted with hot water and filtered through a good filter. The residue is washed thoroughly, dissolved in hot HCl, and evaporated to dryness, after rinsing the filter to separate the trace of silica. The ferric oxide and alumina are precipitated and determined in the usual way, and calculated to iron and aluminium, the silicon being found by difference. A sample of silicon from the electric furnace was in this way found to consist of Si, 98·53 per cent.; Fe, 1·04 per cent.; and Al, 0·43 per cent.—W. G. M.

Pig Iron, Steel, &c., Volumetric Estimation of Sulphur in, by Means of Arsenious Acid. J. Thill. Zeits. anal. Chem. 1899, **38**, [6], 342—344.

A METHOD was required which should combine rapidity with accuracy; the following compares not unfavourably with processes of acknowledged accuracy, and occupies only 60 per cent. of the time ordinarily required for sulphur determinations. The sulphur is evolved as H_2S by treatment with hydrochloric acid in the usual way in a Franke's or a Wiggert and von Reis' apparatus. The hydrogen sulphide is caught in 25 c.c. of decinormal arsenious acid solution mixed with 50 c.c. of a cold saturated solution of sodium bicarbonate. Care is taken that the gas does not come off too rapidly, and after the whole of the hydrochloric acid has been added, and the solution is boiling, the flame is lowered so that the liquid only just boils and no excess of HCl distils over. The last traces of H_2S are driven over by carbon dioxide, and the current of this gas is continued until the HCl gas accompanying it has neutralised the alkaline solution and precipitated nearly the whole of the arsenic trisulphide. This should be accomplished in from 8 to 10 minutes. A few c.c. of HCl are added and the liquid is made up to 500 c.c. and filtered into a dry beaker, from which 100 c.c. are removed for titration (after the addition of starch and sufficient ammonium carbonate to produce an alkaline reaction), with $\frac{1}{30}$-normal iodine solution. The number of c.c. of iodine solution used, is deducted from the number required for 5 c.c. of decinormal arsenious acid solution, and the difference corresponds to the H_2S evolved. This result, multiplied by 0·0024045, gives the amount of sulphur.—W. G. M.

Nitric Acid, New Method for the Determination of. J. F. Pool. Nederl. Tijdschr. Pharm. **11**, 171—174; Chem. Centr. 1899, **2**, [3], 227.

THE following method is stated to give accurate results and to be suitable for the determination of nitric acid in potable waters and manures, &c.

The sample is evaporated to dryness in an Erlenmeyer flask with excess of sodium chloride. The dry mass is decomposed with concentrated sulphuric acid in an atmosphere of carbon dioxide, the mixture diluted with water, and the chlorine completely expelled by boiling, the escaping vapours being collected in potassium iodide solution, and the iodine set free, determined by titration. By working in an atmosphere of carbon dioxide, the nitric oxide formed according to the equation—

$$6HCl + 2HNO_3 = 2NO + 4H_2O + 3Cl_2,$$

is prevented from being further oxidised to compounds, which would themselves set free iodine from potassium iodide.—A. S.

Boric Acid, Iodometric Method for the Determination of. L. C. Jones. Zeits. anorgan. Chem. 1899, **21**, 169; through Chem. Zeit. Rep. 1899, **23**, [27], 262.

THE borate is dissolved in the smallest possible quantity of hydrochloric acid, and the solution so diluted that, on the addition of the iodate-iodide mixture, 25 to 30 c.c. shall contain 0·1 grm. of B_2O_3. The greater part of the free hydrochloric acid is neutralised with sodium hydrate, leaving the solution, however, distinctly acid. 3 to 5 c.c. of a 40 per cent. solution of potassium iodide and 5 to 10 c.c. of a 5 per cent. solution of potassium iodate are then added, care being taken to add sufficient to leave an excess. After decolorisation by thiosulphate, to get rid of the iodine liberated by the hydrochloric acid, iodine is added until a slight yellow colour is produced. The solution is then saturated with mannite (about 10—15 grms. are required for 50 c.c.), and a measured excess of thiosulphate solution of known strength (8 to 10 c.c. over the theoretical quantity) added. After saturating the solution a second time with mannite, if necessary, the former is allowed to stand in the cold for 40—60 minutes, and the excess of thiosulphate is then titrated back with iodine.—H. H. B. S.

Persulphates, Valuation of. G. H. Mondolfo. Chem. Zeit. 1899, **23**, [69], 699.

THIS method consists in decomposing the persulphate by means of potassium iodide, and titrating the iodine separated with thiosulphate solution. 2 to 3 grms. of the sample are dissolved in 100 c.c. of water, and 10 c.c. of the solution are treated with an excess of potassium iodide (0·25 to 0·50 grm.), and heated for 10 minutes in a drying oven at 60°—80°. The iodine is then titrated with N/10 thiosulphate solution, starch being added towards the end of the titration. The percentage of persulphate is calculated from the equation $M^1SO_4 + KI = M^1KSO_4 + I$. 1 c.c. of the thiosulphate solution corresponds to 0·114 grm. NH_4SO_4, or to 0·0135 grm. KSO_4.—T. H. P.

Molasses Potash, Analysis of. — Lacombe. Bull. de l'Assoc. des. Chim. de Sucr. et de Dist. 1899, **17**, [1], 82—86.

IF the potash be boiled with water, there may be double decomposition between the soluble and insoluble salts, vitiating the results. To obviate this inconvenience, Pellet recommends the solution to be made in an extractor such as is used for estimating fats, water taking the place of the ordinary solvents. The first washings thus remove the salts which have passed into solution from the action of the insoluble salts remaining.—L. J. de W.

ORGANIC CHEMISTRY.—QUALITATIVE.

Vegetable Oils, Welmans' Reaction for the Detection of. P. Soltsien. Zeits. öffentl. Chem. **5**, 229—231; Chem. Centr. 1899, **2**, [5], 321.

ACCORDING to the author's observations, Welmans' reaction (this Journal, 1892, 548), is due to the colouring matters which are contained in the oils, so far as the change of the yellow colour of the reagent into green in acid solution is concerned. The further reaction, change to blue coloration in alkaline solution, can also be effected by aldehydes, such as are present in rancid fats. In accord with this is the fact that on the one hand, bleached or chemically altered vegetable oils no longer give the reaction; on the other hand, rancid oils free from vegetable oils show a blue coloration, but not after being distilled with steam (see also this Journal, 1894, 621).—A. S.

Saccharin in Beer, &c., Detection of. R. Kössing. Zeits. öffentl. Chem. **5**, 207—208. Chem. Centr. 1899, **2**, [4], 274.

0·5—1 LITRE of the beer is treated with a small quantity of phosphoric acid, and then agitated, in small portions, for half an hour with about an equal volume of ether. The ether is distilled off, the residue evaporated in a shallow dish, the extract, after addition of sand, completely dried, and then triturated with a small quantity of anhydrous ether. The ethereal solution is treated with an equal volume of benzine (petroleum spirit), after some time, filtered or decanted, the liquid evaporated on a watch-glass, and the light yellow residue placed over sulphuric acid. If saccharin be present, the watch glass becomes covered with white crystals having the characteristic taste.—A. S.

Aldehydes in Alcohol, The Detection of. C. Istrati. Zeits. Anal. Chem. 1899, **38**, [8], 517—520.

THE author utilises the colorations produced by the condensation of the aldehydes with phenols, according to the method of Barbet and Jandrier (this Journal, 1898, 954). To 2 c.c. of the alcohol exactly 0·2 c.c. of a saturated alcoholic solution of the reagent is added, and then 1 c.c. of concentrated sulphuric acid. The results are given in the following table, the concentrations are 1 in 1,000 when not otherwise stated.

Reagent.	Formaldehyde.	Acetaldehyde.	Valeraldehyde.	Acrolein.	Furfural.	Benzaldehyde.	Methylal.	Acetal.
Pyrogallol	..	Reddish-yellow	Orange-red, 1 : 10,000.	Brownish-red	Brownish-yellow, changing to black, 1 : 100,000.	Brownish-red, 1 : 10,000.	Carmine-red	Orange-yellow.
β-Naphthol	Orange-yellow with green fluorescence, red precipitate with water.	Yellow, 1 : 100,000.	Yellow, 1 : 10,000.	Golden-yellow.	Carmine-red, 1 : 10,000.	Carmine-red, 1 : 10,000.	Orange-red, strawberry precipitate with water.	..
α-Naphthol	..	Reddish-yellow, 1 : 10,000.	Orange-red	..	Red, almost black.	Carmine-red, 1 : 10,000.	Yellow, with water green above, red below.	Orange-yellow.
Phenylhydrazine.	Pale brownish-green.	..	..	..	Characteristic green, 1 : 10,000.	Brownish-red	..	..
Hydroquinone	Reddish-yellow	Yellow	Golden-yellow.	..	..	..	..	..
Guaiacol	..	Yellowish-rose	..	Reddish	..	..	Violet-red	..
Orcinol	..	Brownish-yellow.	..	..	Brownish-yellow, 1 : 100,000.	..	..	..
Vanillin	..	Blackish-green, grey-green precipitate with water.	..	..	..	Brownish-red, changing to green.	..	Blackish-green, blue precipitate with water.
Morphine	Violet	..	..	..	..	..	Heliotrope	..
Codeine	Violet-yellow	..	..	Green, 1 : 10,000. 1 drop of reagent.	Brownish-yellow, 1 : 10,000.	..	..	..
Thymol	..	..	..	..	..	Orange-yellow	..	..
β-Orthonaphthoïc acid.	Brownish-yellow (?).	..	Yellow, 1 : 10,000.	Golden-yellow, green fluorescence.	Brownish-yellow, changing to black, 1 : 10,000.	..	..	..
Resorcinol	..	..	..	..	..	Yellow, 1 : 10,000.	..	..
Protogallic acid	Greenish-yellow, disappearing with addition of water.	..	..	..	..	..	Greenish-yellow, disappearing with water.	..
Phenol	..	..	..	..	Yellow	..	..	..
Phloroglucinol	..	..	..	..	Brownish-red, changing to black, 1 : 10,000.	..	..	..
Gallic acid	Greenish-yellow.	..	..	..	..	..	..	..
Camphor	Golden-yellow	..	..	..	..	..	..	..
Brucine	..	..	..	..	..	Red-brown, 1 : 10,000 ; violet, 1 : 100,000.	..	..

—A. C. W.

Margarin, Detection of Yolk of Egg in. Mecke. Zeits. öffentl. Chem. **5**, 231—232; Chem. Centr. 1899, **2**, [5], 321.

Margarin has recently been manufactured with the addition of yolk of egg and sugar. The composition of such a margarin as compared to that of the ordinary kind is as follows:—Total albumin, 2·13 : 0·56 per cent.; coagulated albumin (casein), 1·00 : 0·51 per cent.; albumin in solution, 0·90 : 0·05 per cent.; albumin remaining in solution after boiling, 0·23 : 0·00 per cent.; sugar as milk-sugar, 0·42 per cent. : traces; sodium chloride, 1·80 : 2·06 per cent.; mineral matter—sodium chloride, 0·14 : 0·05 per cent.; water, 14·8 : 13·0 per cent.; fat, 80·71 : 84·32 per cent.; Reichert-Meissl number of fat, 4·0 : 2·5. The yolk of egg may not be replaced by albumin (white of egg), but the addition of sugar is superfluous, as browning is effected by the yolk of egg alone.

Yolk of egg or "*vitellin*" in margarin is detected by melting 100 grms. of the sample at 45° C., thoroughly agitating with 50 c.c. of a 1 per cent. solution of sodium chloride, removing any fat from the aqueous layer by means of petroleum spirit, and, after addition of aluminium hydrate, filtering through a thick filter. The, in most cases, still turbid solution is diluted with 250 c.c. of water, and from this solution, vitellin separates abundantly in white flocks.

Alternatively, the melted margarin may be mixed directly with petroleum spirit, the oily layer run off, the residue repeatedly washed with alcohol, and then treated as above with sodium chloride solution.—A. S.

Morphine and its Derivatives, Detection of. R. Kobert. Chem. Centr. 1899, **2**, [2], 149.

The formalin-sulphuric acid proposed as a reagent for morphine by the author's pupil, Marquis (Chem. Centr. 1897, **1**, 249), is prepared shortly before use by mixing 2—3 drops of *Formaldehydum solutum* with 3 c.c. of concentrated sulphuric acid. The reagent is treated with the powdered substance on a watch glass or in a small porcelain capsule.

Morphine, when treated in this manner, becomes at first purple-red, then violet, bluish-violet, and finally almost pure blue. The blue colour lasts a long time if the solution be protected from the action of the air. When examined with the spectroscope, the blue solution shows an absorption spectrum, orange and yellow being obscured.

Dionine becomes very rapidly deep blue, and remains so, in a narrow test tube, for several hours. With the spectroscope, orange and yellow are darkened, but not so intensely as with morphine. *Codeine* as free base or phosphate is first coloured a reddish-violet, and then blue-violet; the coloration remains for a long time. Orange and yellow are darkened. *Heroine* as free base is coloured first red-violet, then, rapidly, blue-violet; orange and yellow are obscured, the darkened portion being terminated by sharp edges. *Peronine* is coloured red-violet, the olour remaining for several hours. The whole of the pectrum from the yellow towards the right is blotted out. If oncentrated sulphuric acid be added to the solution, yellow, reen, blue, and violet gradually become visible again, hus indicating the absence of a proper absorption band. *Methylphenmorpholine,* either as free base or as hydrohloride, is coloured an intense red, which remains for everal hours. With the spectroscope, orange is only arkened, but the whole of the yellow and green is completely blotted out.—A. S.

Oil of Turpentine, Preliminary Examination of, for Mineral Oils. [*For Custom House Officials.*] C. Schreiber and F. Zetzsche. Chem. Zeit. 1899, **23**, [67], 686.

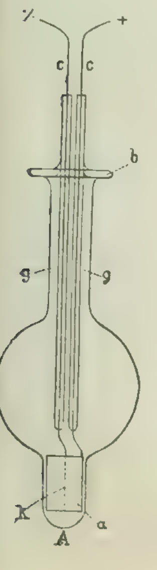
The authors have found that the method described by F. Evers (this Journal, 1898, 607) for the "Custom House" echnical examination of turpentine and patent turpentine requires modification so as to ensure more accuracy. Since the power of turpentine to absorb bromine increases with increase of temperature, a temperature of 20° C. should be adopted in all estimations, and the turpentine should be diluted with alcohol in order to render the action of the bromine complete.

1 c.c. of the sample of turpentine is made up to 50 c.c. with alcohol of 90—95 per cent. This solution is well shaken, and 20 c.c. are measured out into a stoppered cylinder of at least 75 c.c. capacity. Then 20 c.c. of a solution of a mixture of bromide of potassium and bromate of potassium (equal to 40 grms. of bromine in 1 litre) with 20 c.c. of sulphuric acid (1 : 3) are added. The mixture is shaken for half a minute, the temperature being kept at 20° C. The experiment should be carried out in broad daylight only. If decolorisation of the solution and of the finely-divided bromine product take place, the turpentine may be considered pure; if not, a closer examination by experts should be made. The solution of the bromine salts is made by dissolving 15 grms. of potassium bromate and 50 grms. of bromide in 1 litre. The amount of bromine needs to be verified by titration.—S. K.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Nitrogen, Electrolytic Method of Determining, in Organic Substances. C. C. L. G. Budde and C. V. Schou. Zeits. anal. Chem. 1899, **38**, [6], 344—348.

This is a modification of Kjeldahl's method specially adapted for use so that other substances may be determined in the same sample subsequently. The weighed substance is placed in the apparatus shown in the figure, and is there mixed with 4 c.c. of fuming and 8 c.c. of concentrated sulphuric acid (weak acids give low nitrogen results), and electrolysed with a current of 10 ampères and 8 volts. The apparatus consists of a glass bulb tube, of which the bulb should not hold more than 50 c.c. (except when the substance under test froths during electrolysis, in which case the bulb should be of 100 c.c. capacity). The tube portion of the apparatus has a diameter of 2 cm., and is closed at the lower end, forming, below the bulb, a cylindrical cavity (A) of about 10 c.c. capacity. The anode (*a*) is made of sheet platinum (about 1 mm. thick by 50 mm. wide by 30 mm. long) bent into the form of a cylinder, to which, on the middle of the longest side, is welded a 5-cm. length of platinum wire, sealed through the end of a glass tube (*g*), in which, by means of a mercury joint and the loosely-fitting copper wire (*c*), contact is made with the + pole of the generator. The cathode (*k*) is a platinum wire, 18 mm. long and 1 mm. thick, similarly connected with the negative pole of the generator. Both insulating glass tubes (*g*, *g*) are so joined to a glass rod (*b*) resting across the neck of the flask that the cathode is centrally within the anode. In use the flask is inclined somewhat from the vertical to prevent loss by splashing. The starting current will be below 10 ampères (unless the flask be warmed initially), but as the solution becomes warm by its action the current rapidly acquires its full strength. It is thus maintained for about three-quarters of an hour, until the liquid becomes colourless, except for a little black deposit on the cathode and on the bottom of the vessel. At the end of the operation about half the acid will have been decomposed or evaporated, and some SO_2 will have been evolved during the operation, and some sulphur deposited on the neck of the flask. After cooling, an excess of caustic soda is added, and the ammonia is distilled off and determined in the usual way. Since no substance other than sulphuric acid has been added during the process, the liquid, after electrolysis, may be diluted and treated with hydrogen sulphide, filtered, if necessary, boiled to expel H_2S, mixed with excess of caustic soda, distilled for the nitrogen determination, and then re-acidified and precipitated with ammonia and ammonium sulphide. The nitrogen results obtained by this method are usually somewhat higher than those given by the ordinary Kjeldahl method, especially in the case of alkaloids. It is not more applicable than the older method to the examination of closed chain compounds with more than one nitrogen atom in the ring. With such bodies as uric and cyanuric acid it gives results somewhat lower than those yielded by the original process. The whole determination of nitrogen may be completed in an hour and a half.—W. G. M.



Iron in Organic Substances, Determination of. F. Röhmann and F. Steinitz. Zeits. Anal. Chem. 1899, **38**, [7], 433—435.

The substance is strongly heated with concentrated sulphuric acid, to which ammonium nitrate is added in small quantities until a pale yellow, clear liquid is obtained. This solution is diluted in a 150-c.c. flask, neutralised with ammonia and ammonium chloride, and precipitated with ammonium sulphide. The precipitate is allowed to settle, and then filtered off and redissolved in dilute sulphuric acid. Traces of iron retained by the filter are recovered by incineration and treatment with acid potassium sulphate. The iron is finally determined by reduction with zinc and titration with permanganate.—T. E.

Determination of Ferrocyanides in Spent-Oxide. R. Riechelmann. Zeits. öffentl. Chem. **5**, 188—190. Chem. Centr. 1899, **2**, [2], 144.

According to the author's experiments, the method of Donath and Margosches (this Journal, 1899, 519) gives results differing largely from those obtained by Knublauch's method (17 per cent. against 12·3 per cent.). This is due to the fact that, with the latter method, only the ferrocyanide actually present is determined, whilst with the method of Donath and Margosches, the whole of the iron present goes into the alkaline solution, and is reckoned as ferrocyanide. —A. S.

Carbolic Acid and other Phenols, New Method for the Determination of. Riegler. Buletinul soc. de sciinte din Bucuresci, **8**, 51—53. Chem. Centr. 1899, **2**, [5], 322.

Phenol gives, in alkaline solution, with *p*-nitrodiazobenzene chloride, a red azo compound, soluble in water—

$$C_6H_4.NO_2(N:NCl) + C_6H_5OH + 2NaOH =$$
$$NaCl + 2H_2O + C_6H_4NO_2(N:N.C_6H_4ONa).$$

If dilute sulphuric acid be added to the solution till it has a strong acid reaction, and the mixture be well shaken, a yellow compound of the composition $C_6H_4.NO_2(N:N.C_6H_4OH)$ separates practically quantitatively. The *p*-nitrodiazobenzene sulphate may be prepared by mixing together 5 grms. of *p*-nitraniline, 25 c.c. of water, and 6 c.c. of pure concentrated sulphuric acid, adding 100 c.c. of water, then, immediately, 3 grms. of sodium nitrite dissolved in 25 c.c. of water, and making up to 500 c.c. The solution is filtered, and kept in the dark. For the determination of phenol, thymol, guaiacol, &c., 50 c.c. of the aqueous solution of the phenol, containing not more than 0·1 grm. of the substance, is treated with 10 c.c. of a 5 per cent. soda solution, 20 c.c. of the diazo solution added, and then gradually, with constant agitation, dilute sulphuric acid (1 : 5) till the liquid is decolorised or has a strong acid reaction. After 2—3 hours, the insoluble compound is filtered off on to a weighed filter, washed with water till free from acid, and dried at 100° C. To the weight obtained, 0·0002 grm. is added for each 100 c.c. of liquid. In six determinations, the amount of phenol found, varied from that taken by only 0·1—0·2 mgrm.

The method will not answer in the presence of ammonia, its salts, amines, &c., as these give analogous compounds with the *p*-nitro-diazobenzene salt.—A. S.

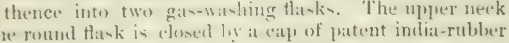
Petroleum, Determination of Sulphur in. S. Friedländer. Arb. Kais. Ges.-A. **15**, 365—372. Chem. Centr. 1899, **2**, [7], 406.

The author describes an apparatus proposed by Ohlmüller, which consists of a lamp, the products of combustion from which are drawn through a long tube, bent at right angles, first into a round flask provided with two tubular outlets, and thence into two gas-washing flasks. The upper neck of the round flask is closed by a cap of patent india-rubber ("Patentgummi"); this serves to equalise the pressure of the air current, and thus to make it possible for the petroleum to burn with a quiet flame free from soot. The washing flasks are filled with a 50 per cent. solution of potassium bicarbonate for the purpose of absorbing the sulphur compounds formed during the burning. The lamp, together with the petroleum, is weighed before and after the experiment. At the end of the experiment, the flame is extinguished by a sudden pressure with the hand on the india-rubber cap, and the suction pump is then allowed to act for a few minutes longer.

The determination is finished by converting the sulphur compounds into sulphuric acid by means of potassium permanganate in acid solution, and then weighing as barium sulphate. The process, when compared with other methods, was found to give good results and to require much less time.—A. S.

Fatty Acids, Identification and Separation of by Tetrachloroquinol [Tetrachlorohydroquinone]. L. Bouveault. Comptes Rend. **129**, [1], 53—56.

Tetrachloroquinol, heated with excess of a chloride of an acid of the aliphatic series, forms both a monacid and a di-acid derivative—



$$C_6Cl_4.(OH)_2 + R.COCl = HCl + C_6Cl_4\begin{cases}OCOR\\OH\end{cases}$$

$$C_6Cl_4.(OH)_2 + 2R.COCl = 2HCl + C_6Cl_4(OCOR)_2$$

The di-derivatives so formed are all easily crystallisable, readily soluble in ether, benzene, or chloroform; less so in petroleum spirit; very slightly in cold, but readily in hot methyl or ethyl alcohol; insoluble in water. They are easily purified, and do not change on exposure to air. They are not acted on by dilute acids or alkalis, but hot strong alcoholic solution of caustic potash decomposes them, forming the potassium salt of the original acid, from which, of course, the acid can be regenerated. The monacid derivatives are also easily crystallisable, and are readily separated from the diacid derivatives by their solubility in dilute alkalis.

To prepare these substances, tetrachloroquinol (once or twice recrystallised from boiling acetic acid to free it from lower chlorinated derivatives), is heated with the acid chloride, in the molecular ratio of 1 to 3, over an oil-bath in a flask furnished with a reflux condenser. When hydrochloric acid ceases to escape, the flask is allowed to cool, and the crystalline mass is taken up with a mixture of ether and water to which has been added some dilute soda solution. The diacid derivative dissolves in the ether, the monacid derivative in the dilute alkali. The solutions are separated; the ethereal solution on evaporation leaves the diacid derivative, which is purified by recrystallisation from boiling methyl alcohol, whilst the monacid derivative is recovered from the alkaline solution by neutralisation with hydrochloric acid.

These compounds, especially the diacid derivatives, are readily individualised, as the melting points of different members of the series differ widely; and, in consequence of the high molecular weight of tetrachloroquinol, a small quantity of the original acid yields a sufficient quantity of the derivative to manipulate, purify, and analyse. The melting-points of the di-derivatives of acetic, propionic, and butyric acids are 245°, 160°, and 137° C. respectively; whilst the mono- and di-derivatives of α-dimethylisocrotonic acid melt at 132° and 130°—134° C. respectively.

Not only identification of a particular acid, but separation of the constituents of a mixture of fatty acids can be effected by means of these derivatives. For this purpose the acids are converted into methyl or ethyl esters, which are fractionated as far as possible. Each fraction is then transformed first into chloride, then into tetrachloroquinol derivatives, and these derivatives are fractionally crystallised, by which means a complete separation can be effected. From the derivatives the acids can be regenerated as mentioned above.—J. T. D.

Fats and Oils, Detection and Estimation of, Free Phosphorus in. E. Louïse. Comptes Rend. 1899, **129**, [7], 394—395.

The author's objections to the ordinary methods of detecting phosphorus when present in traces in a large quantity of oil, are, that it cannot be volatilised from it in a short time by means of a current of steam, whilst if the current be continued for too long, some of it will be oxidised and left behind. Other methods based on the oxidation of the phosphorus are also, in his opinion, inapplicable under these circumstances.

In the method here described, this difficulty is obviated by diluting the oil with acetone and precipitating the phosphorus by means of a concentrated solution of silver nitrate.

Five grms. of the oil are made up to 100 c.c. with acetone, and the liquid is divided into 10 portions. To the first of these is added one drop of a 10 per cent. solution of silver nitrate, the liquid filtered, and the filtrate again tested with silver nitrate. If a coloration be obtained, the second tube is tested with two drops of the reagent in the same way, and so on until a point is reached at which the precipitation is complete. Say, for example, that two drops have been found insufficient, and three too many. Two drops of a 10 per cent. solution of silver nitrate are then added to a fresh portion, and the intermediate point determined by means of a 1 per cent. solution. In this way, traces of phosphorus can readily be determined in terms of standard silver nitrate.—C. A. M.

Glycerin, Determination of Moisture in. G. Benz. Zeits. anal. Chem. 1899, **38**, [7], 436—438.

Aqueous or alcoholic liquids containing glycerin may be dried to constant weight at 100° C. if they are heated in a small flask with a short wide neck, which is covered by a glass cap hanging loosely over the neck, and reaching almost to the body of the flask. This arrangement entirely prevents any loss of glycerin. The drying is complete in about five hours.—T. E.

India-rubber Goods; Analytical Examination of. R. Henriques. Zeits. angew. Chem. 1899, [34], 802.

1. *Determination of Total Sulphur.*—In a shallow crucible of 30 c.c. capacity, 15 c.c. of pure nitric acid are heated on the water-bath. 1 grm. of the finely-ground sample is then slowly added, care being taken to have the reaction well under control, and to prevent loss by keeping, during this operation, the crucible covered with a watch glass. When the whole of the substance is dissolved, the watch glass is removed, wiped with a few small cuttings of filter paper, which are added to the solution, and the latter is evaporated to syrupy consistency. A further addition of 20 c.c. of nitric acid is made, followed by as complete evaporation as possible. The residue thus obtained is mixed with about 5 grms. of a mixture of 5 parts of sodium carbonate with 3 parts of sodium nitrate, and the whole is then fused by the application of a small direct flame. The well-fused mass is allowed to cool, dissolved in water, and the solution filtered. The total sulphur present is found in the filtrate as sulphuric

acid; upon the filter remain all the metals present in the sample, in the form of oxides or carbonates. Any silicic acid the filtrate might contain is removed by the well-known methods.

2. *Determination of Rubber Substitutes in Vulcanised Articles.*—The method formerly described (this Journal, 1893, 463) continues to be used much in its original form. The only slight alteration consists in weighing the extracted india-rubber without the filter paper, from which it was found it can be readily detached without loss.

3. *Estimation of Unsaponifiable Oils in India-rubber Mixings.*—The presence in india-rubber of unsaponifiable oils is frequently observed. Their determination follows immediately upon the determination of the rubber substitutes. The extracted sample is repeatedly kneaded with ether in a mortar until the ether ceases to assume a yellow coloration. The residue is then dried and weighed, the loss of weight being taken as unsaponifiable oil.

4. *Determination of Rubber Substitutes in Unvulcanised Mixings.*—This is sometimes rather difficult, especially in calendered goods. In this case a previous treatment with benzene on the water-bath renders the sample amenable to the ordinary treatment, which is proceeded with without first removing the previously added benzene.

5. *Determination of Unsaponifiable Oils in Unvulcanised Rubber Mixings.*—This is carried out with the rubber residue, obtained from the preceding test by kneading this residue repeatedly with acetone, filtering the acetone solution, evaporating it, and weighing the residue.

6. *Estimation of Carbonic Acid.*—Carbonates, particularly chalk and magnesium carbonate, occur frequently in rubber articles, sometimes also white lead and zinc carbonate. A determination of the carbonic acid may be made by treating the finely ground sample in a Geissler apparatus with acid. Any error which might arise from the presence of sulphides is avoided by substituting for the water charged into the apparatus, a dilute solution of cupric sulphate. Unvulcanised samples are first treated with nitrobenzene according to C. O. Weber's method, and the carbonic acid is then determined in the above-described manner in the residue obtained on filtering this solution.—C. O. W.

Tannin and the Influence of Gallic Acids on the Process, Estimation of. A. Heinemann. Zeits. angew. Chem. 1899, [11], 245.

No processes, except the von Schröder-Löwenthal volumetric and the Simand-Weiss gravimetric methods, are of the least use in valuing materials containing tannin. Vignon's idea of employing silk as a substitute for hide-powder may perhaps be equally practicable with the two processes named. No process whatever can lay claim to real accuracy. The two chief sources of error in the hide-powder methods are (*a*) the undesirable precipitation of various substances (colouring matters, gallic acid, &c.), which were previously held in solution by the tannins, but which are no longer soluble after the tannin has been absorbed by the hide-powder, and (*b*) the absorbing power of the hide-powder for non-tannins. As the solutions used in the volumetric process are less concentrated than those in the gravimetric, the faults under (*a*) are not so serious in the former case; for the same reason, and on account of the larger excess of hide-powder (30 : 1, as against 3 : 1), (*b*) forms the chief defect of the volumetric method. This may partly be avoided by conducting the tannin absorption in stronger liquids (1 : 100), and diluting 1 : 500 before titration. When the two processes yield different results, the gravimetric one is always lower, and probably more correct. The difference can only be explained by the absorption of bodies other than tannin, which reduce permanganate powerfully. The difference, also, is roughly proportional to the amount of gallic acid present.

Mixtures of tannins with gallic acid cannot be valued by the volumetric process, for 1 grm. of the dry acid reacts with the same quantity of permanganate as 1·505 grm. of dry tannin. Provided the solution does not contain more than 5 or 10 per cent. of gallic acid, the gravimetric process is fairly trustworthy, each 1 per cent. of gallic acid up to 15 per cent. increasing the yield of tannin by 0·19 per cent., and from 15 to 30 per cent. by 0·17 per cent. A large excess of hide-powder in a dilute liquid, absorbs almost all the gallic acid; 3 grms. per 1 grm. of tannin in 100 c.c. is sufficient.

The Weiss-Eitner-Simand process is not satisfactory; and it must be remembered that the effect of adding 1 grm. of hide-powder three times in succession, and filtering between each, as practised by Weiss, is widely different from that of introducing 3 grms. at once. The former plan leads to increased absorption of gallic acid. Gravimetrically, Vignon's method requires enormous weights of silk (11 : 1); apart from this, the modification is fairly good. Volumetrically it exhibits all the defects of the von Schröder-Löwenthal process, except that it absorbs far less gallic acid.

On the whole, the following seems to be the best method of conducting the operation:—The hide-powder is agitated with twenty times its weight of water, allowed to settle, and filtered through linen; this is repeated six or eight times, and finally it is extracted with alcohol, filtered, and dried at 100° C. The tannin solution should contain from 1 to 1·5 grm. per 100 c.c.; it is treated with 3 grms. of hide-powder, and allowed to react for 14 or 16 hours, with occasional agitation. The mass is filtered through paper, the filtrate tested for tannin with a 1 per cent. solution of gelatin containing (as a preservative) a trace of phenol, and, if thought necessary, with a solution of pure tannin for dissolved hide-powder. If neither be present, an aliquot portion is evaporated to obtain the non-tannins and the tannins by difference.

The author complains that hitherto analysts have always approached this problem from the leather manufacturer's point of view, whereas the value of a particular "tannin" is by no means the same to the tanner, the dyer, and the writing-ink maker. Gallic acid is simply an impurity in the two former businesses, but it is very serviceable in the preparation of an iron ink. The article concludes with sundry speculations as to the theoretical constitution of the tannins (this Journal, 1899, 409).—J. G. P.

Mannose, Determination of, in presence of other Sugars. E. Bourquelot and H. Hérissey. Comptes Rend. **129**, [6], 339—341.

The basis of the method is the formation of a mannose hydrazone insoluble in cold water. To the solution of the sugars is added a mixture of phenylhydrazine, glacial acetic acid, and water. After a few hours the precipitate is filtered off by the aid of the pump, washed with ice-cold water, alcohol, and ether, dried, and weighed. The results are fairly accurate if the solutions contain not less than 3 to 6 per cent. of mannose; with more dilute solutions, they come out too low by about 4 per cent. of the mannose present.
—J. T. D.

Methyl Alcohol in Alcohols, Improvement of Trillat's Method for the Detection of. J. Wolff. Ann. Chim. anal. appl. **4**, 183—184; Chem. Centr. 1899, **2**, [3], 229.

In making an examination of Trillat's method (this Journal, 1898, 879; 1899, 711), the author found that dimethylaniline by heating to 70°—75° C. in a closed vessel in presence of acetic acid and a few drops of methyl- or ethyl alcohol, yields, after 3 hours, a condensation product which behaves similarly to Trillat's base. The amount of this product formed increases with the temperature and the time of heating. The distillate from a pure alcohol oxidised with chromate mixture, gave the same reactions. If the mixture be only heated to 60°—65° C., or allowed to stand for 24 hours at the ordinary temperature, the base is no longer formed.

It was also found that the condensation product of dimethylaniline and methylal is decomposed by long boiling with soda solution.

In view of these facts, the author has modified Trillat's method as follows:—100 c.c. of the alcohol are distilled, and the first 10 c.c. of the distillate taken for the test. 15 grms. of potassium bichromate are dissolved in 130 c.c. of water, 70 c.c. of pure sulphuric acid (1:5), and the

10 c.c. of distillate added, the mixture allowed to stand for 20 minutes, and then distilled. The first 25 c.c. of distillate are rejected, and of the next 100 c.c., 50 c.c. are treated with 1 c.c. of pure dimethylaniline, and the mixture allowed to stand in a well-closed flask for 24 hours at the ordinary temperature. After addition of 4—5 drops of a very dilute solution of phenolphthalein, the liquid is accurately neutralised with soda solution, some small pieces of pumice stone put in, and 30 c.c. distilled off. The residue is treated with 25 c.c. of water, and 1 c.c. of acetic acid, and the coloration formed with PbO_2 observed as in Trillat's method.—A. S.

Formaldehyde, Detection and Estimation of. C. Neuberg.
Ber. 1899, **32**, [11], 1961—1964.

p-Dihydrazinodiphenyl forms a characteristic hydrazone with formaldehyde, applicable both qualitatively and quantitatively. Aqueous solutions of the hydrochloride of this base give, after a short time at ordinary temperatures, and immediately on warming to 50°—60° C., a flocculent yellow precipitate with formaldehyde, even in dilute solutions, which has the constitution $(C_6H_4.HN.N:CH_2)_2$. This is insoluble in alcohol, benzene, ether, and many other solvents, but is decomposed by acids. This reaction has the advantage over the phloroglucinol and resorcinol tests, in that formaldehyde can be distinguished from furfural and other analogous compounds. If other aldehydes or ketones be present, twice the volume of alcohol is added to the liquid under examination, when only the formaldehyde compound remains undissolved, or else the mixed hydrazones are extracted with strong alcohol, and an insoluble yellow residue indicates the presence of formaldehyde. The substance turns orange at 166° C., and melts about 220° C.: the delicacy of the test is about 1 : 5000. For quantitative purposes only the purest recrystallised hydrochloride must be used, giving colourless aqueous solutions. To a cold solution of the salt in water, the formaldehyde solution is slowly added whilst stirring, and the whole then warmed to 50°—60° during 15 minutes. The precipitate is allowed to settle, filtered off in a Gooch crucible, washed in succession with hot water, alcohol, and absolute ether, and dried at 90° C. The concentration of formaldehyde should be 1—2 parts in 1,000 of water. In spite of the error introduced at other concentrations, it is by far the best way of estimating formaldehyde in presence of other similar compounds, in which case 1—2 volumes of methyl alcohol should be previously added to the liquid to be tested.—J. F. B.

Chloral Hydrate, Official Test for. F. H. Alcock and T. H. Thomas. Pharm. J. 1899, **63**, [1524] 236.

In the B.P. test for chloral hydrate, 4 grms are treated with 30 c.c. of N caustic soda, when no more than 6 c.c. of N sulphuric acid should be required to neutralise the soda which remains free on the completion of the reaction.

Following the above directions and with a sample which was undoubtedly pure and contained no chloral alcoholate, results were obtained which appeared to indicate considerably more than 100 per cent. of real chloral hydrate. Where 6 c.c. of sulphuric acid ought to have been required, in one case, only 2·4 c.c. were required.

It was found that the untrustworthiness of the official method is due to the fact that chloroform undergoes decomposition when standing in contact with caustic soda solution, sodium chloride and formate being formed.

The authors recommend the following modification of the B.P. method:—4 grms. of the sample are treated in a stoppered bottle with 30 c.c. of N-caustic soda, and the mixture shaken vigorously for a few minutes, without the application of heat. On titrating back with N-sulphuric acid, using litmus as an indicator, 5·8 c.c. should be required for complete neutralisation.—A. S.

Chloral Hydrate, Official Test for. F. Pilkington Sargeant. Pharm. J. 1899, **63**, [1524], 236.

The author confirms the conclusions arrived at in the preceding abstract. He found that when the chloral hydrate was added to the normal alkali in the proportions recommended by the B.P., secondary decompositions appeared to take place above 60° C., whilst below 45° C., the primary reaction did not appear to occur. The most nearly correct results (differing only by 1 per cent. in 12 determinations) were obtained by warming for 5 minutes at 50° C. before titrating back. The author concludes that the B.P., or Meyer's method, is not suitable for determining the amount of chloral hydrate in a solution, that the chloral hydrate should be added direct to the alkali, and not be previously dissolved, and that secondary reactions take place in inverse proportion to the amount of chloral hydrate and excess of alkali present, and in direct proportion to the heat applied.—A. S.

Vanilla, Determination of the Vanillin in. W. Busse. Arb. Kaiserl. Ges. 1898, **15**, 1—13; through Zeits. für Untersuch. der Nahrungs- und Genussmittel, **2**, [6], 519—521.

A known weight of vanilla pods, disintegrated with sand, is extracted with ether in a Soxhlet tube and the ethereal extract is shaken out with aqueous solution of sodium bisulphite; from the latter solution the vanillin is liberated with H_2SO_4, and the SO_2 thus generated, is removed by a current of CO_2. The vanillin is then extracted from the acid solution by shaking out with ether, the solvent evaporated, and the residue weighed. Tiemann and Haarmann found in the best Mexican vanilla 1·69 and 1·86 per cent. of vanillin; in the Bourbon variety 1·91 to 2·90; in that from Java 2·75 per cent. The author found in German East African vanilla 2·16 per cent., in Ceylon vanilla 1·48 per cent., in Tahiti vanilla 1·55 and 2·02 per cent. There appears to be no connection between the amount of vanillin present in a sample of pods, and its value for flavouring purposes, since the most aromatic and best flavoured vanilla frequently contains less vanillin than an inferior quality. The aroma and flavour of vanilla is not, therefore, entirely due to vanillin. —J. O. B.

Santonin, Quantitative Determination of. J. Katz.
Arch. Pharm. 1899, **237**, 245.

The author uses the following in preference to the other known methods of determining the amount of santonin in the plant:—10 grms. of the coarsely powdered wormwood seeds are extracted with ether for 2 hours in a Soxhlet apparatus, and after distilling off the ether, the residue is boiled for 20 minutes with a 5 per cent. solution of barium hydrate under an inverted condenser. The solution is then cooled and saturated with carbonic acid, filtered quickly, and the residue washed twice with 20 c.c. of water. The filtrate is evaporated on the water-bath to about 20 c.c., then treated with 10 c.c. of 12·5 per cent. hydrochloric acid, left 2 minutes more on the water-bath, and then cooled. The product is placed in a separating cylinder, and shaken with about 20 c.c. of chloroform, which dissolves the santonin. The chloroform solution is filtered and evaporated, and the residue is boiled with 50 c.c. of 15 per cent. alcohol for 10 minutes under an inverted condenser, the solution is filtered hot into a weighed flask, and allowed to stand for 24 hours. The alcohol is poured off from the separated santonin through a weighed filter, which is then dried along with the crystallised santonin, and weighed. A correction of 0·006 grm. per 10 c.c. of filtrate must be made for the solubility of santonin in the alcohol. The author quotes a number of results to show the reliability of the method.—G. H. B.

Pilocarpine, Assay of Preparations containing, and the Characters of Pilocarpine Nitrate and Hydrochloride. H. A. D. Jowett. The Wellcome Chemical Research Laboratories Rep. **6**, 1—7.

The mixture of amorphous bases, extracted from jaborandi by any of the available methods, is dissolved in a small quantity of a saturated alcoholic solution of pilocarpine nitrate, and to the solution a strong alcoholic solution of nitric acid (freshly prepared) is added, until it is faintly acid. A crystal of pilocarpine nitrate is then added, and the mixture allowed to stand 2 hours. The separated crystals are filtered off, washed with the alcoholic solution of pilocarpine nitrate, and weighed. In most cases the precipitate may be assumed to consist of pilocarpine nitrate only; if the melting point be 174° C. it contains pilocarpine only; if the melting point lie between 167° and 174° the proportion of pilocarpine is 80—90 per cent. If an accurate estimation be required, the percentage of the alkaloid may be calculated from the following formula:—

$$p = \frac{100}{43{\cdot}7}(x - 38{\cdot}5),$$

where x is the specific rotatory power of the nitrate obtained. If the nitrate melts below 167° C., it must be recrystallised from absolute alcohol before weighing.

Pilocarpine Nitrate is easily purified by repeated recrystallisations from strong alcohol. This salt was prepared from true jaborandi, from the small-leaved variety (Maranham jaborandi) and from two commercial samples. In each case the product possessed the same properties, which were not altered by further recrystallisation. The melting point was 178° C., $[\alpha]_D = +82{\cdot}9°$, solubility in water, 1 in 6·4 at 20° C. The commercial samples yielded by recrystallisation about 85 per cent. of the pure nitrate. The impurity is a nitrate of lower melting point and rotatory power, possibly that of pilocarpidine.

Pilocarpine Hydrochloride was prepared from the pure nitrate and recrystallised; it melts at 204°—205° C., $[\alpha]_D = +91{\cdot}74°$.

The author does not recommend that absolute purity should be required of these salts for medicinal purposes; he suggests the following characteristics and tests:—The nitrate forms white distinct crystals, permanent in the air, soluble in 6—7 parts of water at the ordinary temperature, in 146 parts of cold 95 per cent. alcohol, almost insoluble in ether and chloroform. In a capillary tube it should melt at 176°—178° C.; its specific rotatory power in aqueous solution should be between + 81° and + 83°. A concentrated aqueous solution should give no precipitate with ammonia, aqueous potash, or soda; this test distinguishes the salts of this from those of most other alkaloids. The hydrochloride forms white deliquescent crystals, soluble in less than their own weight of water and in 10 parts of absolute alcohol, and almost insoluble in ether and chloroform. The salt, dried at 100°, melts at 200°—204° C. Its specific rotation should be + 90° to + 92°. The strong aqueous solution gives no precipitate with ammonia, and only a few oily drops which quickly redissolve on the addition of caustic potash or soda.—A. C. W.

Alkaloids and their Salts in Chloral Hydrate, Solubility of. E. Schaer. Zeits. Anal. Chem. 1899, **38**, [8], 469.

See under XX., *page* 943.

Water and Sewage, Analysis of. Report of Committee of Brit. Assoc. 1899.

See under XVIII. B., *page* 939.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Silicon, Silica, and Alumina, Action of Chlorine on a Mixture of. E. Vigouroux. Comptes Rend. **129**, [6], 334—335.

Silica is reduced at a red heat by aluminium, the product cooled out of contact with air, and the cooled mass is exhausted by hydrochloric acid and aqua regia, to remove remaining aluminium and traces of iron. The washed and dried residue, treated with chlorine at a red heat, yields a pure silicon chloride.—J. T. D.

Acetylene and Mono-Substituted Acetylenes, Action of Hypochlorous and Hypobromous Acids on. N. M. Wittorf, Russian Physico-Chemical Society. Chem. Zeit. 1899, **23**, 659.

Hypobromous acid acts on acetylene at ordinary temperatures, forming dibromacetaldehyde, which forms two crystalline hydrates. Hypochlorous and hypobromous acids give with allyls dichlor- and dibromacetones, and with trimethylallyls crystalline dichlor- and dibrompinacolines, which were found to be identical with the like compounds obtained direct from pinacolines.—G. H. B.

Acetylene, Metallic Derivatives of. Berthelot and Delépine. Comptes Rend. 1899, **129**, [7], 361—378.

Berthelot's theory is confirmed that acetylene and carbides of the formula C_2M_2 may be compared with ammonia and nitrides, whilst carbide derivatives $[(C_2M_3)R]$ correspond to ammonium salts.

The carbides of hydrogen, silver, sodium, and probably potassium are endothermic, whilst those of lithium and calcium are exothermic.

Mono-potassium carbide (C_2HK) and mono-sodium carbide (C_2HNa) are known, and probably a similar silver salt exists, though it has not yet been isolated. As might be anticipated from the amount of heat absorbed in their formation, these bi-metallic compounds are less stable than the others.

According to Berthelot, acetylene may be compared with many simple acids in the gaseous condition, and notably with hydrogen sulphide as regards the substitution of its hydrogen by metals. The following table shows the amount of heat in calories liberated by the substitution of sodium or silver for the hydrogen in the gaseous acids and in acetylene, the metallic compound being in the solid state:—

——	H_2 by Na_2	H_2 by Ag_2
2HCl	+ 151·8	+ 14·0
2HBr	+ 155·0	+ 29·6
2HI	+ 150·0	+ 41·2
2HF	+ 144·4	− 20·6
2HCN	+ 106·2	− 7·0
H_2S	+ 84·5	+ 1·2
$2(NO_3)H$	+ 152·6	− 11·4
C_2H_2	+ 49·3	− 29·05

It is pointed out that when the substitution of the gaseous hydrogen by sodium is accompanied by the evolution of a considerable amount of heat (144 to 150) the salts are not hydrolysed to any extent when dissolved in water. But, on the other hand, alkali sulphides and cyanides, which have a much smaller heat of substitution, undergo considerable dissociation in water, whilst alkali carbides are completely dissociated.

The substitution of the hydrogen by silver gives much more divergent results, the heat varying with each acid, and being negative with some, and notably with acetylene. The salts are not decomposed, however, by cold water, since there would be a considerable heat of formation in the separation of the silver oxide, which would occur if decomposition took place.

In the reactions taking place between water and carbides, two opposite phenomena are to be observed. Some carbides are decomposed with the formation of metallic oxides or hydroxides and acetylene, whilst, conversely, certain hydroxides are acted upon by acetylene with the formation of carbides as in the equation—

$$C_2H_2 + Ag_2O = C_2Ag_2 + H_2O.$$

On this point the authors remark that given the heat of formation A, of a carbide C_2M_2, from the elements, and the heat of formation 2Q, of a hydroxide, 2ROH, the course of the reaction will depend on the direction of the inequality $A + 138 \gtrless 2Q - 58{\cdot}1$ if one take into account only the formation of acetylene by the action of water on the metallic carbide. The authors have also examined the nitrates, sulphates, chlorides, and iodides of what they term "argentacetyl," in which the radicle C_2Ag_3 appears to play the same part as silver. They have had certain indications of the existence of an intermediate radicle, C_2HAg_2, but leave the question unsettled.

Argentacetyl nitrate $(C_2Ag_3)NO_3$ is obtained by the action of acetylene on a solution of silver nitrate. It is strongly explosive. It is decomposed by hydrochloric acid with the liberation of acetylene, and by an excess of ammonia in solution, with the formation of silver carbide—

$$(C_2Ag_3)NO_3 + 2NH_3 = C_2Ag_2 + NO_3NH_3[NH_3Ag].$$

Nitric acid also decomposes it and yields crystals of silver cyanide.

There are several argentacetyl sulphates. The double sulphate ($C_2Ag_2 . Ag . SO_4$) is obtained by the direct action of gaseous acetylene on a solution of silver sulphate in excess. It is a white salt, which explodes feebly *in vacuo.*

If the current of acetylene be continued, the white precipitate becomes yellow, and the whole of the silver is precipitated, forming a compound with a composition corresponding to the formula $(C_2Ag_3)_2SO_4 + C_2Ag_2 . Ag . SO_4$. By leaving this compound sulphate in prolonged contact with an aqueous solution of acetylene, the authors have succeeded in obtaining the normal sulphate $(C_2Ag_3)_2SO_4$.

Several chlorides of argentacetyl have been isolated. By dissolving freshly precipitated silver chloride in concentrated ammonium hydroxide, and passing a feeble current of acetylene through the liquid until the first appearance of a yellow colour, a white precipitate is obtained with the composition (C_2Ag_3) Cl. It has feeble explosive properties. When an ammoniacal solution of silver chloride is mixed with sufficient hydrochloric acid to nearly precipitate the salt, and a current of acetylene passed through, a lemon-yellow precipitate is obtained, the composition of which agrees with the formula—

$$C_2Ag_3Cl,\ C_2Ag_2 \text{ or } C_2Ag_2(C_2Ag_3)Cl.$$

This has greater detonating properties than the preceding chloride.

By prolonging the action of the acetylene, precipitates more and more yellow are obtained, such as, for example, one corresponding to the formula $C_2Ag_3Cl, 2C_2Ag_2$. There are also several iodides. Silver iodide dissolved in potassium iodide solution is not precipitated by acetylene even after the addition of ammonia; but if a small quantity of potassium hydroxide be added, a precipitate is gradually formed, especially on shaking the liquid in a closed vessel. If this precipitate be filtered off and the current of acetylene continued, a fresh precipitate of identical composition is produced. When washed successively with concentrated and dilute solutions of potassium iodide and then with water, these have a composition corresponding with the formula $C_2Ag_3I + AgI$. This salt detonates feebly.

The authors have obtained an analogous double iodide of "cuproacetyl" with the formula C_2Cu_3I,CuI.

By acting upon argentacetyl nitrate with a solution of potassium iodide, and arresting the reaction as soon as the liquid becomes alkaline, a green precipitate is formed, having the composition $C_2Ag_2 + AgI$ or C_2Ag_3I. This compound has strong detonating properties.—C. A. M.

Iodic and Periodic Acids. A. Rosenheim and O. Liebknecht. Annalen, **308**, 40—67.

The authors show that free iodic acid is a dibasic acid of the formula $H_2I_2O_6$; that the di-iodates are acid salts, the potassium salt, for example, having the formula KHI_2O_6; and that when these acid salts are neutralised by alkali, a splitting up of the ions occurs, with formation of normal iodates, the salts of a hypothetical acid HIO_3.

By heating 1 mol. of alkali iodate for some time with 1 mol. of molybdenum trioxide, filtering the boiling solution, and allowing to crystallise, molybdoiodates are obtained, of the formula $R_2OI_2O\ .2MoO_3$, identical with those described by Chrétien. The study of the physical properties of these shows them to be acid salts, $RIO_3 . MoO_3$, analogous to the di-iodates; on neutralisation, they behave similarly to these latter.

Silver iodate dissolves in excess of strong ammonia; if this solution be evaporated over caustic alkali without access of air (or escape of ammonia), brilliant white needles are obtained of the substance $AgIO_3 . 2NH_3$.

From disodium periodate, $Na_2H_3IO_6$, there can be prepared by precipitation with silver nitrate the corresponding silver salt, $Ag_2H_3IO_6$. By prolonged boiling with water, or still more rapidly, by treatment with ammonia, this salt is converted into the salt Ag_3IO_5. The same salt is obtained, practically pure, by adding to the boiling solution in dilute nitric acid of $Ag_2H_3IO_6$, excess of silver oxide and filtering. If the sodium salt above referred to, or, still better, the salt $NaIO_4$, be treated with excess of neutral solution of silver nitrate, a black precipitate of Ag_5IO_6 is obtained. From the study of these salts, as well as of the complex periodates shortly to be mentioned, the authors conclude that periodic acid is to be regarded as pentabasic, though it forms with strong bases (alkalis) stable monobasic salts, derived from a meta-periodic acid, HIO_4.

The authors have prepared two sets of tungsto-periodates. By long boiling of a mixture of sodium periodate and carbonate $(2Na_2H_3IO_6 + 3Na_2CO_3)$ with freshly precipitated tungstic acid, till the latter remains in excess, filtering, and evaporating to a syrup, minute needles of sodium hexatungsto-periodate $(5Na_2O . I_2O_7 . 12WO_3 + 16H_2O)$ were obtained, from which, by double decomposition, the corresponding potassium, barium, and strontium salts were prepared. By adding gradually to a boiling solution of 20 grms. of sodium paratungstate, 15 grms. of sodium periodate, diluting largely, and washing the dense precipitate by decantation, sodium monotungsto-periodate $(3Na_2O . I_2O_7 . 2WO_3 + 4H_2O)$ is yielded as a white non-crystalline powder.—J. T. D.

Copper Alkali Tartrates and Fehling's Solution. F. Bullnheimer and E. Seitz. Ber. 1899, **32**, [13], 2347—2352.

The existence of a compound of the formula $C_4H_2CuNa_2O_6$ in Fehling's solution is generally assumed. Attempts to prepare this substance resulted in compounds containing 2 mols. of tartaric acid to 1 mol. of copper oxide. The following crystalline compounds were obtained by digesting together copper hydroxide, tartaric acid, and alkali:—

$$C_4H_2O_6CuNa_2 + C_4H_2O_6Na_4 + 13H_2O,$$
$$C_4H_2O_6CuK_2 + C_4H_2O_6K_4 + 8H_2O,$$
$$C_8H_4O_{12}CuNa_4K_2 + 11H_2O,$$
$$C_8H_4O_{12}CuNa_3K_3 + 11H_2O.$$

The solutions of these compounds are not decomposed on boiling, whilst the solution of the substance $C_4H_2O_6CuNa_2 + 2H_2O$ deposits copper oxide on boiling.

Ammonium compounds corresponding to those described, could not be obtained; a solution of copper tartrate in excess of ammonia containing alcohol, deposits on cooling the compound $C_4H_4O_6Cu(NH_3)_4 + 2H_2O$. The compound $C_4H_2CuO_6Cu(NH_3)_4$ was also prepared.—A. C. W.

Sodium Fluoride, Toxic Action of. H. B. Baldwin. J. Amer. Chem. Soc. 1899, **21**, [6], 517—521.

The author describes two recent cases of poisoning by sodium fluoride, which had been accidently introduced into cakes in place of baking powder. Where the patients died, the amount taken was estimated to be from 9 to 10 grms.

In order to experimentally determine the influence of gradually increasing doses of the salt, the author experimented on himself and found that 0·25 grm. produced nausea in two minutes, which increased in intensity for twenty minutes, and did not disappear until the second day.

—C. A. M.

New Books.

Lexicon der Kohlenstoff-Verbindungen. Von **M. M. Richter.** Zweite Auflage der "Tabellen der Kohlenstoff-Verbindungen nach deren empirischer Zusammensetzung geordnet." Erste bis 12te Lieferung. Verlag von Leopold Voss. Hamburg and Leipsic. 1899. Price M 1.80 per each Part (Lieferung). Williams and Norgate, 14, Henrietta Street, Covent Garden, London. H. Le Soudier, Paris. G. E. Stechert, New York.

This work is really an enlarged and extended edition of the author's "Tables of Carbon Compounds," and is complementary to Beilstein's Handbuch der organischen Chemie. So far, Parts 1 to 5 have appeared, but the complete work will contain 35 parts, which are to be issued before the close of the current year. The work will give descriptive references to upwards of 67,000 compounds, and is arranged in the following sections:—Introduction, System and Nomenclature. The Index of Symbols to about 67,000 compounds, and the numbers giving the percentage compositions of these. Alphabetical index of the names of the carbon compounds. Numerical Tables for discovering the percentage composition. The arrangement of the index of Carbon Compounds is based on the gradual increase of these compounds in carbon content, and of the number of elements with which the carbon is combined. Thus, the sub-divisions in the open pages are headed as follows:—"C_1—Group with one Element," "C_1—Group with two Elements," "C_1—Group with three Elements," and so on.

There is no extended description given of properties, &c., &c., beyond melting points and boiling points, and percentage composition, but brief references to literature, original papers, &c., are appended.

Part 1 contains 80 pages of matter; Part 2, 64 pages, and Parts 3 to 12, 64 pages each. With the conclusion of Part 12 (page 784) the later members of the "C_9 Group with five Elements" are reached.

The Elements of Blowpipe Analysis. By Frederick H. Getman. The Macmillan Company, London and New York, U.S. America. 1899. Price 60 cts.

Small 8vo volume containing 77 pages of matter, subdivided as follows:—I. Apparatus and Reagents. II. General Outline of Blowpipe Analysis. III. General Reactions for the detection of the Metallic Elements in Simple Compounds. IV. Behaviour of some of the Principal Ores before the Blowpipe. V. A Series of Six Comparative Tables.

Chemisch-technisches Repertorium. Uebersichtlicher Bericht über die neuesten Erfindungen, Fortschritte und Verbesserungen auf dem Gebiete der technischen und industriellen Chemie, mit Hinweis auf Maschinen, Apparate und Literatur. Herausgegeben von Dr. Emil Jacobsen. 38. Jahrgang. 1899. Erstes Halbjahr. Zweite Hälfte. Mit in den Text gedruckten Illustrationen. R. Gaertner's Verlagsbuchhandlung, Hermann Heyfelder, Schönebergerstr. 26, Berlin, S.W.

The present is the number of the "Repertorium" for the second half of the first half-year of 1899, and it treats of the following subjects of Chemical Technology:—I. Foodstuffs. II. Paper. III. Photography. IV. Residuals, Manures, Disinfection, and Sanitation. V. Soaps. VI. Explosives and Matches. VII. Preparation and Purification of Chemicals. VIII. Fine Chemicals, &c. IX. Chemical Analysis. X. Apparatus, Machinery, Electrotechnology, and Thermo-technology. XI. Appendix, &c. XII. New Books.

The Chemical Trade Directory, 1899, of Chemical Manufacturers, Merchants, Agents and Brokers, Assayers and Analysts, and Makers of Chemical Plant and Materials, in Great Britain and Ireland. Davis Bros., 32, Blackfriars Street, Manchester. 1899. Price 21s. nett.

This Directory, of 8vo size, contains 384 pages of matter, classified as follows:—List of Chemical Products contained in Section V.; ditto in Section VI. List of Advertisers. Chemical Manufacturers. Chemical Merchants, Agents, and Brokers. Makers of Plant and Materials. Salt Proprietors of Great Britain and Ireland Analysts, Experts, and Samplers. Advisers to Associations. County and district Agricultural Analysts. City and Borough Analysts. Classified List of Specialists. Towns with Analysts practising therein. Classified List of Chemical Products. Chemical Plant Makers. Advertisements.

The Chemistry of Essential Oils and Artificial Perfumes. By Ernest J. Parry, B.Sc., &c. Scott, Greenwood, and Co., 19, 21, and 23, Ludgate Hill, London, E.C. 1899. Price, 12s. 6d.; abroad, 14s.

8vo volume, containing 400 pages of subject-matter preceded by a preface and table of contents and followed by the alphabetical index. The pages are illustrated with 20 wood engravings. The text is subdivided as follows:—I. General Properties of Essential Oils. II. Compounds occurring in Essential Oils. (i.) Terpenes. (ii.) The Camphor Series. (iii.) The Geraniol Series. (iv.) Benzene Compounds. (v.) Aliphatic Compounds. III. Preparation of Essential Oils. IV. Analysis of Essential Oils. V. Systematic Study of the Essential Oils. (i.) Wood Oils. (ii.) Fruit Oils. (iii.) Leaf Oils. Oils of the Angiosperms. (*a*.) Monocotyledons. (*b*.) Dicotyledons. VI. Terpeneless Oils. VII. Chemistry of Artificial Perfumes. Appendix. Table of Constants of the more important Essential Oils. In this table, occupying the first column, are the names of all the Essential Oils arranged in alphabetical order. In the second column are the sources of supply of these oils; in the third, the yields per cent.; in the fourth, the specific gravities; in the fifth, the optical relations; and in the sixth, descriptions of the constituents, the principal constituent in each case being in thick type.

Verdampfen, Kondensiren und Kühlen. Erklärungen, Formeln und Tabellen für den praktischen Gebrauch. Von E. Hausbrand. Julius Springer's Verlag, Berlin. 1899. Price M. 9.

This work, illustrated with 21 engravings, is of 8vo size, and contains the preface, table of contents, numbered description of the tables throughout the work, a reference table descriptive of the symbols and signs used in connection with formulæ, equations, &c., the subject-matter, occupying 384 pages, and an alphabetical index. The contents are as follows:—I. Coefficient of the transmission of Heat *k*, &c. II. Transmission of Steam, &c. in identical or contrary directions. III. Arrangements for Heating by Direct Fire. IV. Injection of Saturated Steam. V. Superheated Steam. VI. Evaporation by means of Hot Liquids. VII. Transmission of Heat in general and of saturated steam in particular. VIII. Transmission of saturated steam in tubes (worms) and under false bottoms. IX. Evaporation in Vacuo. X. Evaporation by Multiple-effect Apparatus. XI. Ditto. XII. Weight of water which must be evaporated from 100 kilos. of liquor in order to raise the original content of dry material from 1—25 per cent. up to 20—70 per cent. XIII. Mutual Relation of the heated surfaces of the single parts of Multiple-effect Apparatus, and their true magnitude. XIV. Pressure exerted by Currents of Steam and Gases on drops of water in motion. XV. The Directions imparted to falling drops of water by currents of Steam and Gas. XVI. The Casting up of Masses from Boiling Liquids. XVII. Width of Pipes, &c. for Steam, Alcohol, and Steam and Air. XVIII. Width of Water Pipes. XIX. Loss of Heat of Apparatus and Tubes to Surrounding Air. XX. Condensors. XXI. Heating of Liquids. XXII. Cooling of Liquids. XXIII. Volume of Air which Air-Pumps must draw off from Condensors. XXIV. Air-Pumps and the Exhaustion effected by them. XXV. Volumetric Efficiency of Air-Pumps. XXVI. Volumes which must be exhausted from Vessels in order to reduce the Interior Pressure to an estimated minimum.

Inorganic Chemistry for Advanced Students. By Sir Henry Roscoe, F.R.S., D.C.L., LL.D., and Arthur Harden, Ph.D., M.Sc. Macmillan and Co., Ltd., London and New York. 1899. Price 4s. 6*d*.

This small work, about the size and shape of the "Elementary Lessons in Chemistry" of the first author, contains the preface, table of contents, and subject-matter, occupying 424 pages, illustrated with 54 engravings, and the alphabetical index. The work is divided into chapters, at the close of most of which are summaries of the gist of the contents, and at the close of all of which, are selections of appropriate exercises.

The contents are as follows:—1. Molecular and Atomic Weights. 2. Determination of the Molecular Weights of Gases and Volatile Liquids and Solids. 3. Solution and Crystallisation. 4, 5, and 6. Halogen Elements. 7. Action of Alkalis on the Halogens. 8. General Properties of the Halogen Elements. 9. Equivalents. 10. Metals and Non-Metals. 11. Nitrogen Group. 12, 13, and 14. Elements of the Nitrogen Group. 15. Determination of Atomic Weight from the Specific Heat of the Solid Element. 16. Crystals. Isomorphism. 17. Alkali Metals. 18. The Alkali Manufacture. 19. The Alkali Metals continued. 20. Constitutional Formulæ, &c. 21. The Ammonium Compounds. Dissociation. 22. Metals of the Alkaline Earths. 23 and 24. Zinc Group of Metals. 25 and 26. Copper Group of Metals. 27. Thermo-Chemistry. 28. Electro-Chemistry. 29. Aluminium Group of Elements. 30 and 31. Carbon Group of Elements. 32 and

33. Iron Group of Metals. 34. Chromium. 35. Manganese. 36. Platinum, Argon, and Helium. 37. Classification. The Periodic System. 38. Determination of the Molecular Weights of Dissolved Substances. 39. Spectrum Analysis.

Trade Report.

INLAND REVENUE NOTICE.

Tinctures and Essences for Exportation.

Somerset House, W.C.,
September 28, 1899.

Adverting to the correspondence which has taken place between the Board of Inland Revenue and the Chemical Trade Section of the London Chamber of Commerce on the subject of the exportation on drawback of tinctures, essences, &c., the Lords Commissioners of Her Majesty's Treasury have consented to certain modifications in the regulations applicable thereto.

The Board have accordingly issued the following instructions to their officers, and have directed them to notify the change in the allowance for waste to the several traders concerned:—

"A uniform allowance of 3 per cent. for waste is to be made upon all preparations packed for exportation on and after the 1st October next, under the regulations applicable to the exportation of tinctures or medicinal spirits, flavouring essences, and perfumes, *including those preparations not at present entitled to any allowance for waste*, except spirits of wine and spirits to which any ingredient is added under the regulations in the presence of the officer."

The margin of difference for error in the statement of the strengths of the preparations as made by the exporters and that found upon examination of the samples at the Government Laboratory, will also be increased from 2 to 3 degrees.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

(From the Board of Trade Journal.)

Russia.

Cyanide of Potassium, Free Importation of.

The Minister of Finance, in agreement with the Minister of Agriculture and Imperial Domains, has sanctioned for the requirements of Siberian and Ural gold mining the free importation into Russia of cyanide of potassium, on condition that, in each separate case, a certificate be obtained from the district mining engineer of the Crown, his assistant, or from the mining administration, to be presented to the custom house at which the goods are clearable, stating that the cyanide of potassium which has arrived at the custom house is really required for the working of gold and is imported by a certain person or company to be named.

Quebracho Wood, Free of Duty.

The United States Consul-General at St. Petersburg states that, for the purpose of encouraging the leather industry in Russia, the Government has decided to place the quebracho tree—found in Chile and Mexico—on the free list.

The principal material for tanning in Russia is willow bark. This contains but 4 per cent. of tannin, while the quebracho tree yields 20 to 24 per cent., and is necessary for the preparation of leather of a high grade. Previous to 1882 tanning material was admitted free, but during that year a duty of 2¼*d.* per 36 lb. was levied; this was reduced to 1¼*d.* per 36 lb. in 1896. Last year a committee appointed to consider this question decided, inasmuch as quebracho wood is not grown in Russia, is a necessity, and is only used as a mixture with willow bark and other tanning material employed in the leather industry, to admit quebracho wood in logs and beams free of duty from and after 15th February 1899.

The loss of duty is estimated at 4,500*l.* annually, and it is expected that sum will be more than replaced by the increased manufacture of leather. Russia is rich in raw skins, which are being exported to England, Germany, and Finland. These countries receive their tanning material free of duty, and export leather to Russia.

"Asbestos Paint," Duty on.

Under the designation "Asbestos Paint" a colour preparation has been frequently introduced from the United Kingdom across the Hamburg Customs frontier, which is used in electro-technical establishments for rendering, by impregnation, the cotton covering of the wires conveying the electric current incombustible. This preparation is composed of about 19 per cent. water, 15 per cent. linseed oil, and 66 per cent. inorganic substances (principally oxide of lead and oxide of zinc), and contains no asbestos whatever. The preparation is consequently dutiable as "painters' colours," according to No. 5a 2, at 200 marks per 100 kilos. (Order of July 14, 1899).

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

Molybdenite in Sweden and Norway, Production of.

Bd. of Trade J., Oct. 1899, 461.

Her Majesty's Consul at Stockholm states that the mineral molybdenite is frequently found in some of the most important iron-ore fields, but that it has been worked to hardly any extent. The largest quantities have been found in the mines at Vestanfors and on an island called Ekholm.

The "Knaben Molybdenite Mine" in Fjotland produced 5,000 kilos. of molybdenite in 1897 with 10 to 18 men employed.

According to the manager of the mine (which has now ceased working), Mr. Vice-Consul Eyde, of Flektefjord, the molybdenite was sold in 1896 for 2*s.* 2*d.* per kilo., but prices fell in 1897, so that the mine did not pay, which caused the stopping of the production of molybdenite.

The cost of working varied between 6½*d.* and 1*s.* 8*d.* per kilo., according to the quality of the molybdenite and the rent of the mine.

Cement at Bangkok (Siam).

Foreign Office Annual Series, No. 2353, *Sept.* 1899.

In 1898, 11,275 casks of cement were imported, worth 5,411*l.* This came mostly from England, but also from Germany, Belgium, Denmark, and Hong-Kong. A German line in iron drums finds favour although more expensive, as, owing to the method of packing, it stands the climate better.

Albumin Factories at Wuhu (China).

Foreign Office Annual Series, No. 2340, *Aug.* 1899.

Mr. Fraser notices, in his report for 1897, the establishment by Germans during that year of two albumin factories at Wuhu. Both are in steady work and doing a satisfactory business. One has passed, after several vicissitudes, into the hands of a British firm, Messrs. Smith and Meyer. During the early part of the year yet another albumin factory, under Chinese ownership, was started on the north bank of the Yangtze, a few miles from Wuhu. This is also said to be doing a good business.

Sumach Trade of Sicily.

Bd. of Trade J., Oct. 1899, 468.

The Syndicate or Joint Stock Company for the sumach business began its operations on the 1st August, but these have been limited, with very little exception, to the purchase of sumach leaf and lentisco at the following prices, *viz.*, lire 17.40 per 100 kilos. for baling leaf, equal to about 10*l.* per ton delivered at the mills, Palermo, and lire 17.15 per 100 kilos. for grinding leaf, equal to about 10*l.* 16*s.* 8*d.* per ton delivered Palermo; the shipments up to the present have only been a few hundred bags, and under 250 bales of leaf in all. The number of sumach mills in Palermo and Termini is nine; the proprietors of all are members of the Company, as also all the shippers of the article, every one of them being shareholders as well; merchants who are not shareholders cannot ship sumach. The Syndicate can only sell to their appointed agents in all the consuming countries, and these same are the agents who for many years have represented the exporters of sumach from Palermo. Only three mills are destined for the grinding of sumach, *viz.*, Terrasi, Basso and Company, and V. Vitrano. Other three are destined for the grinding of lentisco, *viz.*, Pajero and Company, Falcone, and Mormino, of Termini. It is probable, however, that Mormino, of Termini, may be allowed to grind sumach when the demand is more than the three in Palermo can supply, in which case Casiglia would grind lentisco; the other mills will remain closed till required, but will participate in their share of the profits. The f.o.b. price, compared with the purchase price of the leaf, leaves a good margin for profit.

CHEMICAL TRADE OF EASTERN ROUMELIA: IMPORTS AND EXPORTS AT THE PORT OF VARNA DURING THE YEAR 1898.

Foreign Office Annual Series, No. 2357, Sept. 1899.

Classes of Goods.	Imports.		Exports.		Observations (Proportions compared with Previous Year 1897: Gross Value per Ton, &c.).
	Quantity.	Value.	Quantity.	Value.	
	Tons.	£	Tons.	£	
6. Alcohol, wine, beer, liqueurs, &c.	559	8,710	..	4	Imports: increase, 3,125*l.* = 59 per cent. Value per ton, 15*l.* 10*s.*
9. Fuel	3,527	4,430	43	45	Imports: decrease, 4,220*l.* = 50 per cent. Value per ton, 1*l.* 5*s.*
10. Chemical products	371	4,465	..	..	Imports: decrease, 885*l.* = 16 per cent. Value per ton, 15*l.*
11. Dyestuffs, paint, and varnish	366	7,110	12	48	Imports: decrease, 875*l.* = 11 per cent. Value per ton, 20*l.*
12. Resins, gums, and mineral oils	2,141	8,815	..	4	Imports: decrease, 7,025*l.* = 40 per cent. Value per ton, 4*l.* 3*s.*
13. Oils, fats, wax, and their products.	952	27,365	..	11	Imports: decrease, 14,355*l.* = 34 per cent. Value per ton, 29*l.*
14. Drugs, medicines, &c.	31	2,465	..	..	Imports: about same. Value per ton, 80*l.*
15. Perfumery	4	650	..	36	Imports: about same.
16. Earthenware, glass, and stoneware.	6,612	18,835	19	163	Imports: increase, 2,235*l.* = 12 per cent. Value per ton, 3*l.*
17. Metals, rough and manufactured.	11,741	89,090	16	127	Imports: about same. Value per ton, 8*l.* 6*s.*
19. Paper and paper-pulp	553	11,590	3	15	Imports: about same. Value per ton, 21*l.*
20. Leather, skins, and furs, dressed and undressed.	425	37,895	347	32,184	Imports: decrease, 19,420*l.* = 33 per cent. Value per ton, 90*l.* Exports: increase, 24,550*l.* = 330 per cent. Value per ton, 92*l.* 10*s.*
22. India-rubber and oilcloth	5	1,100	..	..	
27. Articles other than above, including gunpowder, matches, &c.	3,369	4,960	..	..	
Total 1898	46,000	611,100	63,235	426,000	
Total 1897	49,500	772,400	82,412	484,600	
Percentage of decrease	− 0·07	− 0·20	− 0·23	− 0·12	

The largest items, such as sodas, alums, and ammonias (about one-third to one-half of the whole) are chiefly of British origin, but citric acid and most of the other chemicals come from Austria.

Austria, followed by Germany, heads the trade in dyes, paints, varnish, &c., of 7,000*l.*, which was to be expected, especially in the case of aniline dyes; but it seems strange that the two countries should furnish more Bengal and Madras indigo than the United Kingdom, unless, indeed, the new synthetic product manufactured by the Badische Anilin und Sodafabrik has already found its way to this market.

Russian petroleum represents three-fourths of the value under the head of resins, gums, mineral oils, &c. Most of the gum olibanum, the incense used in church ceremonies, but little of any other gums, resins, tars, &c., is imported from London.

The total value of imports under the head of vegetable oils, fats, wax, and products is 27,365*l.*, or a third less than in 1897; but it is only in linseed oil that the United Kingdom is interested, and this to the extent of about 600*l.*

Turkey supplies the major portion of the olive and other vegetable oils, about 18,000*l.*, and about four-fifths of the soap, 5,000*l.*, this being the common Cretan kind sold here at 21*s.* per cwt.; while Belgium and Holland furnish the stearine candles, of which, however, not much over 1,000*l.* worth is imported.

Notwithstanding that their manufactures are protected, the Bulgarian soap boilers do not seem to make much headway, and, in view of the probable diminution of imports from Crete, owing to the olive trees having been cut down and destroyed in many places, there might be an opening for British manufacturers were it not that the religious susceptibilities of the large resident Mussulman population prevent their buying any other soap than that made from olive oil. As it is, Greece proper will probably reap the benefit and largely increase their present imports of that description.

Hydraulic lime is being largely employed for the harbour works here and at Bourgas, but it all comes from Marseilles, which also ships tiles to Bulgaria.

As regards cement, about 1,800*l.*, the United Kingdom has to take a position below Austria, Germany, and Belgium.

Belgium has the virtual monopoly in window glass; while in stoneware, 1,800*l.*, and glass hollow-ware, Austria heads the list, followed by Germany and France.

In zinc (2,000*l.*) Germany comes first and the United Kingdom only third after Belgium, but the United Kingdom still keeps in the front rank as regards bar tin (1,500*l.*) and copper (7,000*l.*) in sheets, &c., while Germany and Austria between them account for nearly the whole of the fancy metal articles.

India-rubber goods mostly come from Austria, but Russia supplies rather more than half the galoshes.

CHEMICAL TRADE OF BOSNIA.

Foreign Office Annual Series, No. 2356, Sept. 1899.

The various industrial establishments in the country seem again to have had a prosperous year, especially the ammonia-soda factory at Lukavica, near Tuzla, and the brewery of the Actiengesellschaft at Serajevo.

Chemical Works.—The two most important factories in Bosnia are the Holzverwerthungsfabrik, at Teslic, and the Elektricitätswerke, at Jaice.

The former of these produces methylic alcohol, acetone, pyroligneous acid, acetate of lime, tar, and charcoal; also railway sleepers and building timber are chemically impregnated to preserve them from rot. A considerable portion of the machinery is now being reconstructed, as a new patent process hitherto employed did not prove successful, and at the same time the works are being considerably enlarged. They require yearly 120,000 cubic metres of beechwood, furnished by the Government from the surrounding forests, which are said to be inexhaustible. At the present moment 400 workmen are employed, of whom about half are natives, but when the enlarged works are completed nearly double that number will be required. Their pay varies between 70 kr. and 3 fl. (1*s.* 2*d.* and 5*s.*) per diem. They are well lodged and cared for. Colonial goods and all simple articles of food and clothing are supplied to them at cost price, and as the drinking-water is not wholesome they are provided gratis with an unlimited supply of aerated water prepared on the premises. A school for the workmen's children, of which there are at present over 70, is also maintained by the Company, and the instruction is free.

Electro-Chemical Works.—The Elektricitäts-Actiengesellschaft at Jaice has obtained from the Government the exclusive right to employ the water-power of the famous Sliva waterfall, from which, it is said, 30,000 horse-power can be obtained without detriment to the beauty of the fall. At present only 10,000 are being utilised for the production of electricity, employed as the motive power in large chemical works producing chiefly calcium carbide. The process employed is a secret, and access to the works very difficult. They are said to be the largest calcium carbide works in Europe.

The Government sugar factory at Usora showed a net profit for the first time, amounting to about 80,000 fl. (6,667*l.*).

Mineral Production in 1897.

Mineral.	Output.	Value.	
		Currency.	Sterling.
	Tons.	Florins.	£
Iron ore	36,509 +	79,086	6,590 +
Copper ore	3,432 –	24,060	2,005 –
Manganese	5,259 –	84,429	7,036 –
Chrome ore	390 –	13,870	1,156 –
Iron pyrites	3,612 +	18,351	1,529 +
Salt	13,699 +	974,323	81,194 +
Brine, galls.	25,045,240 –	45,536	3,795 –

The addition and subtraction signs indicate whether there was an increase or decrease compared with the previous year.

Chemical Trade of Bulgaria.

Foreign Office Annual Series, No. 2357, *Sept.* 1899.

Imports during the Years 1897–98.

Articles.	1897.		1898.	
	Quantity.	Value.	Quantity.	Value.
	Met. Tons	£	Met. Tons	£
Metals, and metal goods.	31,435	379,989	43,649	428 893
Hides, skins, leather, &c.	1,849	197,594	1,664	158,128
Stone, lime, cement, glass, &c.	27,614	110,711	32,804	112,621
Oils, soap, candles, &c.	5,163	132,665	3,713	101,589
Mineral oils, tar, &c.	18,378	105,561	16,276	80,808
Paper, and paper goods	3,558	79,057	3,506	76,534
Wine, beer, spirits	1,921	33,084	4,138	65,090
Dyes, paint, &c.	1,996	73,047	2,050	49,927
Fuel	32 604	30,134	28,473	29,573
Chemical products	1,901	27,958	1,768	26,670
Drugs, mineral waters, &c.	225	22,019	184	18,554
India-rubber goods	65	16,597	57	13,492
Perfumery, toilet soap, &c.	35	6,374	33	5,697
Silkworms' eggs, manure, &c.	52	7,350	52	4,523

Exports during the Years 1897–98.

Articles.	1897.		1898.	
	Quantity.	Value.	Quantity.	Value.
	Met. Tons	£	Met. Tons	£
Hides, skins, &c.	1,354	60,166	1,148	107,506
Perfumery	46	71,949	55	103,670
Fuel	2,950	1,883	10,009	5,711
Metals, and metal goods.	894	10,109	544	3,229
Sumac, &c.	1,234	3,345	691	1,951
Wine, vinegar, beer, &c.	234	1,936	185	1,804

Cement, British, in San Francisco.

Foreign Office Annual Series, No. 2349, *Sept.* 1899.

The demand for cement last year was good, owing mainly to the United States Government requiring large quantities for fortifications; and prices were satisfactory also. Hereunder is shown the quantity imported during the last two years:—

From	Quantity.	
	1898.	1897.
	Lb.	Lb.
Belgium	55,890,713	40,015,610
Great Britain	37,416,600	30,191,656
Germany	23,515,200	17,694,800
France (of Belgian origin)	3,360,000	1,764
Total	120,182,513	87,903,830

It will be seen, on comparing the two sets of figures, that the British manufacturer's gain in the increased importation amounts only to 23·93 per cent., while his German and Belgian competitors have profited to the extent of 32·89 per cent. and 48 per cent. respectively.

The explanation of this contrast affords another illustration of what has now become an old story. Several years ago one of the largest dealers in cement in San Francisco discovered that a new quality had been introduced from the Continent of Europe, and that it was meeting with the approval of consumers, on account of its greater fineness and somewhat lower price. It was to the advantage and convenience of this merchant to continue to take his supplies from England, his firm having its only European establishment there. He therefore notified the manufacturers of the danger to their joint interests, and recommended them to sift with a finer mesh and modify their price a little. Failing to make any impression by letter, he crossed the Atlantic and laid the state of affairs before them personally. But they remained, notwithstanding all his efforts, perfectly convinced that they were making as fine a cement as the world had any need of, and that it was good value for the money they asked. So, like a prudent man of business, he carried his firm's patronage elsewhere, and is now importing from Germany only. The Consul adds that he has now been, as a Consular representative, in three countries in which he has seen importers transfer custom to the Continent of Europe because the producers of the United Kingdom were too slow in adapting their goods to changing markets.

Carbon Monoxide in San Francisco Gas.

Foreign Office Annual Series, No. 2349, *Sept.* 1899.

The large number of deaths from gas asphyxiation that have taken place in San Francisco during recent years, either by accident or with suicidal intent, have had the effect of directing official attention to the quality of the city's illuminant. An analysis shows that the gas furnished by one company contains an average of 16·44 per cent. of carbon monoxide, while that supplied by other makers contains 24·33 per cent.

MINERAL PRODUCTS OF CALIFORNIA IN 1898.

Foreign Office Annual Series, No. 2394, *Sept.* 1899.

The following figures, which have been compiled by the State Mineralogist, show the yield and value, for the year 1898, of the principal Californian mineral products :—

Articles.		Yield.	Value.
			Dols.
Gold	..	..	15,906,478
Copper	Lb.	21,543,229	2,475,168
Petroleum	Barrels	2,249,088	2,376,420
Quicksilver	Flasks	31,092	1,188,626
Borax	Tons	8,390	1,153,000
Asphalt	,,	25,690	482,175
Silver	..	..	414,055
Coal	Tons	143,045	337,475
Lime	Barrels	297,860	254,010
Mineral waters	Gallons	1,429,809	213,817
Salt	Tons	93,421	170,855
Soda	,,	7,000	154,009
Cement	Barrels	50,000	150,000
Granite	Cb. ft.	98,369	147,732
Bituminous rock	Tons	46,836	137,575

CHEMICALS IMPORTED TO STETTIN DURING 1897–98.

Foreign Office Annual Series, No. 2345, *Sept.* 1899.

—	Quantity.	
	1897.	1898.
	Tons.	Tons.
Phosphate	84,626	73,155
Thomas slags	20,330	11,377
Chili saltpetre	509	410
Superphosphate	10,515	20,491
Sulphate of ammonia	2,915	2,416
Bone manure	3,952	3,141
Total	122,847	110,990

CEMENT TRADE OF STETTIN.

Foreign Office Annual Series, No. 2345, *Sept.* 1899.

There was a large demand and sale of all products of the cement industry during 1898. The principal cause of the increased call for "Portland" cement and the consequent stiffening in the price was the great demand occasioned by concrete work coming more and more into favour, and the fact that some factories had greatly over-estimated their output when accepting large orders.

Several new cement factories are, however, being built, and the present factories are making extensive enlargements, so that sooner or later there will certainly be an over-production.

The Stettin Portland Cement Factory employed over 600 hands. The wages paid were at an average rate of 2 marks 50 pf. to 3 marks (2*s.* 6*d.* to 2*s.* 11½*d.* per day). After writing off a large sum for depreciation, &c., a dividend of 24 per cent. was declared. These works have been enlarged at a cost of 13,250*l.*

The Stettin-Bredow Portland Cement Factory has also enlarged its works and paid a dividend of 12⅓ per cent. 13,600*l.* were paid in wages for 95,219 working days.

The "Stern" Portland Cement Works has increased its production by 10 per cent., and 26,795*l.* were paid in wages to 618 hands, which is an average of 2 marks 77 pf. (2*s.* 9*d.*) per man per day. The sale in Stern cement drain pipes was very large.

The Pommersche Industrial Company shipped above 400,000 casks (of 180 kilos.) from their cement works in Lebbin and Wolgast in 1898, and paid 28,935*l.* in wages. There was a great demand for bricks during the whole year.

A cement factory is also being built by the "Kraft" Ironworks. Formerly the production of cement from the slag was not successful; it is only lately that slag-sand, free from impurities (manganese, &c.), has been produced. The powdered slag-sand is mixed with a certain quantity of lime, formed into bricks, and burnt like Portland cement, and then finely ground. The slag cement is alleged to be equal to the Portland cement, and fetches the same price.

The following were the oversea exports :—

—	Quantity.	
	1898.	1897.
	Tons.	Tons.
Cement	80,900	59,800
Bricks	11,300	31,600
Fireclay goods	13,600	7,500

CHEMICAL WORKS IN POLAND.

Bd. of Trade J., October 1899, 415.

At Lazy, where two of the largest cement works in Poland are situated, one producing three and the other one and a half millions of pouds of cement a year, German influence is supreme. All the machinery in the works and steam engines are of German make, and the stoves are on the German system. There are chemical works at Lowicz, started by a Belgian, and electrolytic works at Lombkowice, started in 1896 by some Polish capitalists in conjunction with a Berlin company, and it is said that both are doing very well. The former produce superphosphates and sulphuric, hydrochloric, and nitric acids, and the latter chloride of lime, calcium carbide, caustic soda, &c.

APOCYNUM VENETUM AS A TEXTILE PLANT.

U.S. Cons. Reps., October 1899, 330.

Some years ago, an explorer in Asia discovered a plant of silken fibre, used by the Turkomans for the manufacture of withes and cord, and by the Canagues for woven goods. This plant, known as *Apocynum venetum*, is a sort of bush with slender cylindrical branches, sometimes 6 feet high. It grows in Europe, Siberia, Asia Minor, the north of India, Manchuria, and Japan; but it is not cultivated, and up to the present has been used only in the natural state. The branches die yearly, and in the spring new shoots start horizontally from the roots. It flourishes best where the land is under water during a part of the year, notably in the neighbourhood of rivers that overflow at stated periods. Under favourable conditions the *Apocynum* develops quickly, and in a short time the branches form a thick growth, almost like a miniature wood. The best fibre is obtained by cutting the branches in midsummer, when the plant has obtained its full growth. The attention of the Russian Government was called to this plant in 1891. It is there known as the *Apocynum sibericum*, because it was first seen in Siberia. It grows luxuriantly on the banks of the Amu-Darya and the Ili, and the natives of these regions have used the fibre for many years for cord and fish nets. They value it not only for its great strength, but also because no care is required in its cultivation. In 1895 the Russian Government began to use it in the manufacture of bank notes, and since then the plant has been cultivated at Poltava. The results obtained thus far are considered excellent, and the time is doubtless near when the *Apocynum venetum* will take an important place in the textile market.—*Commercial Intelligence.*

WOOD FLOUR IN GERMANY.

U.S. Cons. Reps., Oct. 1899, 216.

Wood flour (in German, Holzmehl) is made by grinding sawdust to a fine powder, and is used for two general purposes, *viz.*, the manufacture of explosives, and (2) the manufacture of linoleum and papyrolite, or artificial flooring. It is regarded as distinctly inferior to infusorial earth for making explosives, and is only used when extreme cheapness of product is desirable or the infusorial earth cannot be obtained. It has also been used in the manufacture of linoleum, but was found to be hard, inelastic, and inferior to cork meal, so that its use has been, so far as can be ascertained, abandoned by most German makers of linoleum. If used at all for this purpose, it is done secretly, and would be regarded as an adulteration.

The third and by far the most important use of wood flour in Germany is for the manufacture of papyrolite or xylolite, a kind of artificial flooring, which is extensively produced by several large firms.

Papyrolite is extensively used as flooring for kitchens, halls, corridors, and for cafés and restaurants. It is a substance between wood and stone, practically fireproof, impervious to water, and, being a non-conductor of heat, is warm in winter. It is also used as flooring on German war vessels, because it has most of the advantages of wood, but does not splinter from shot nor take fire.

The German product, which is made from sawdust that has no value except as fuel, is abundant at from 4 to 5 marks per 100 kilos., which is a price so moderate as to offer little encouragement for imports.

Wood Flour in Scotland.

U.S. Cons. Reps., Oct. 1899, 217.

Nobel's Explosives Company is about the only user of the flour in Scotland. The secretary of that company states that only about 400 tons per year would be used in connection with explosives in Scotland. While refusing to give the price paid, he said it was higher than 4*l.* 3*s.* 10*d.* per ton.

Manganese Mining in Bahia.

U.S. Cons. Reps., Oct. 1899, 267.

During the past six months another mine of manganese has been opened up in the State of Bahia, making at present two mines in operation. They are each situated about 16 miles from the town of Nazareth, near the village of São Antonio de Jesus, on the Nazareth tramroad, a line of narrow gauge running from Nazareth to Amargosa, 49 miles distant and tributary to the rich Bahia coffee district.

The amount of ore available cannot be estimated with any degree of accuracy, on account of the irregularity of its occurrence. The estimated yield of the mine just opened was first placed at 176,000 tons, but more than this amount is now expected. The other mine is at present acknowledged to contain at least three times as much; so the total quantity in sight may be placed at 700,000 tons, with the chances of greatly exceeding that amount. The land in the vicinity of these two mines has been prospected, and manganese has been found, though poorer in quality and much less in quantity than that now being worked.

The ore as found is the hydrous oxide of manganese known as "psilomelane." It is associated with irrecognisable schistic rock, and averages about 42 per cent. of pure oxide of manganese. Its principal impurity, which affects its commercial value, is 11 to 12 per cent. of silica. It also has from 3 to 4 per cent. of oxide of iron; fractional percentages of lead, lime, sulphur, cobalt, phosphorus, and copper; between 12 and 13 per cent. of alumina; and from 5 to 7 per cent. of combined water.

Tobacco Juice in France.

U.S. Cons. Reps., Oct. 1899, 236.

All tobacco shops in France are compelled to keep a stock of what is called "tobacco juice, rich in nicotine and guaranteed." This is manufactured by the tobacco monopoly in Paris. This article, it is claimed, possesses the following advantages :—

(1) It is free from all matter susceptible of fermentation, and keeps for an indefinite period of time if in closed vessels.

(2) It contains no resinous matter and is almost transparent; therefore it does not injure or clog the spraying machines, and does not stain plants or flowers or the wool of sheep.

(3) It has a Government guarantee as to the proportion of nicotine it contains, which never varies.

This product, sold throughout France, is packed in tins of 5 litres, 1 litre, and half a litre, at the rate of fr. 13·50 for 5 litres, fr. 3·0 for 1 litre, and fr. 1·75 for half a litre.

It is claimed that this product contains from five to six times the quantity of nicotine that may be found in ordinary tobacco juice, and that therefore one-fifth to one-sixth of the quantity will accomplish the object to which it is applied. For spraying purposes, the product is employed in the proportion of one part of juice to one hundred parts of water. It is stated that the spraying of plants should be done after sunset, and that they should be sprinkled with clear water on the following day. For fumigating hothouses, the proportion is one part of juice to five of water. The mixture is sprayed upon bricks or iron sheets heated to a temperature sufficiently high to produce rapid evaporation. It is claimed that insects and parasites are absolutely destroyed by this process. It is said, furthermore, that the preparation is most efficacious for the destruction of all insects on cattle, as well as being a preventive of all manner of parasitic attacks. For these purposes, the juice is mixed in the proportion of one part to twenty of water. It is recommended that the lotion be not used as a general bath, but applied gradually on limited surfaces. It should not be brought in contact with sores or erosions of any kind. The benefits accruing from the use of these mixtures are said to be greatly enhanced by mixing 100 grms. of soda crystals with each litre of diluted juice.

GENERAL TRADE NOTES.

Paraffin Candle Manufacture in Burma.

Petroleum Ind. and Techn. Rev., Oct. 14, 1899.

The recently formed branch of the Burma Oil Company's business, that of candle manufacture, which was only begun towards the latter end of 1897–98, and has proved highly successful, affected the import candle trade of the province during the year 1898–99 to a marked extent, particularly that in light weight or "pagoda" candles, which are chiefly of Belgian manufacture, and the importation of which has for the present practically ceased, as the Burma Oil Company product can undersell them. The Burmese did not at once take to the locally made candles, says *Indian Engineering*, but these have grown in popularity, and there is now a great demand for them.

Tanning Industry in India.

Leather Trades Review, Oct. 10, 1899.

The *Madras Mail* says the decline in the tanning industry has been extremely marked since 1895, after a period of continuous prosperity extending over 20 years. Tanned hides used to be exported to London and thence to the United States of America; but at a later stage they were despatched direct to America, and particularly to Boston. The prosperity of the Indian tanning industry was then at its height. Fully three-fourths of the skin and hide produce of India used to find its way to Madras for the purpose of undergoing the operation of tanning; and there were about 500 tanneries in the Madras Presidency alone, each employing several hundreds of workmen. Calcutta and Bombay could only secure a very small portion of the business. But in 1890, factories were opened in Calcutta for the purpose of drying raw hides for export. The Americans made large purchases of these, and proceeded to dress them over there. The American method had a considerable advantage over the Indian process, for while the latter extended over thirty or forty days, the former only required about five days. There was a considerable money saving by the new process; for by the Indian method the cost of tanning a skin was, on an average, roughly 3½ annas, but by the American method it was much less.

Accordingly there was a great decline in the Indian tanning industry, which was much aggravated by the action of the United States Government, which in 1897 imposed an import duty of 18 per cent. on tanned skins and hides, and a duty of 5 per cent. on dried skins. The few surviving tanneries export tanned skins and hides to London, whence about three-fourths are taken up by Germany, the remaining fourth being required for the English market. Even this small industry is now in jeopardy, for the Germans are commencing to carry on tanning themselves, and have commenced to order raw skins and hides direct from India. The Americans also are making experiments with a view to curtailing the period required for the process of tanning. They are sanguine of reducing the time from five days to a single day; and to effect this they have been employing electrolysis for the purpose of unhairing.

BOARD OF TRADE RETURNS.

Summary of Imports.

Articles.	Month ending 30th September	
	1898.	1899.
	£	£
Metals	1,568,331	2,224,837
Chemicals and dyestuffs	317,426	352,366
Oils	813,115	814,577
Raw materials for non-textile industries.	5,706,649	5,826,760
Total value of all imports	35,557,488	38,721,079

Summary of Exports.

Articles.	Month ending 30th September.	
	1898.	1899.
	£	£
Metals (other than machinery)	2,567,238	3,601,532
Chemicals and medicines	672,238	692,482
Miscellaneous articles	2,790,342	2,894,704
Total value of all exports.....	19,945,085	22,374,807

Imports of Metals for Month ending 30th September.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
Copper :—			£	£
Ore .... Tons	15,454	16,928	65,826	127,575
Regulus .... "	7,831	10,017	192,309	295,482
Unwrought ..... "	5,250	4,086	275,376	312,602
Iron :—				
Pig and puddled "	10,775	12,309	45,541	53,962
Ore .... "	387,331	543,798	271,980	408,975
Bolt, bar, &c. ... "	6,895	6,209	55,750	48,028
Steel, unwrought.. "	3,365	2,189	20,388	15,889
Lead, pig and sheet "	10,921	10,103	140,352	151,610
Pyrites .... "	39,293	45,887	60,361	70,668
Quicksilver .... Lb.	8,960	17,020	896	1,710
Silver ore....... Value £	..	..	81,205	56,172
Tin .... Cwt.	12,968	39,698	46,630	277,168
Zinc.............. Tons	6,010	6,181	116,659	145,311
Other articles ... Value £	..	..	195,058	259,685
Total value.........	..	..	1,568,331	2,224,837

Imports of Oils for Month ending 30th September.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Cocoa-nut....... Cwt.	17,077	43,914	16,577	51,411
Olive............ Tuns	655	1,127	22,645	38,233
Palm .... Cwt.	69,927	67,222	76,332	74,216
Petroleum ...... Gall.	23,375,283	18,767,646	380,831	362,141
Seed............ Tons	3,689	3,301	63,283	67,332
Train, &c. ...... Tuns	3,232	2,946	49,872	48,941
Turpentine ..... Cwt.	112,960	52,221	122,101	87,924
Other articles Value £	..	..	81,474	84,379
Total value	..	..	813,115	814,577

Imports of Chemicals and Dyestuffs for Month ending 30th September.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali............ Cwt.	19,363	24,697	10,275	13,042
Bark (Tanners', &c.) "	28,772	15,012	8,297	6,602
Borax .... "	137	10,116	139	4,952
Brimstone .... "	17,530	49,608	4,453	11,466
Chemicals...... Value £	..	..	90,653	102,835
Cochineal .... Cwt.	213	332	1,202	1,734
Cutch and gambier Tons	721	1,076	13,645	17,482
Dyes :—				
Alizarin.......Value £	..	..	19,893	17,337
Anilin and other "	..	..	43,316	43,795
Indigo .... Cwt.	250	384	4,075	6,378
Nitrate of potash.. "	13,460	12,979	10,852	12,122
Valonia .... Tons	1,693	1,769	17,269	16,940
Other articles ...Value £	..	..	93,357	98,281
Total value.........	..	..	317,426	352,366

Imports of Raw Material for Non-Textile Industries for Month ending 30th September.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Bark, Peruvian .. Cwt.	2,585	2,010	6,001	6,573
Bristles.......... Lb.	468,216	530,317	59,146	64,719
Caoutchouc ...... Cwt.	33,444	26,312	459,085	319,921
Gum :—				
Arabic .... "	2,737	4,744	5,915	10,275
Lac, &c. .... "	2,491	9,496	7,840	31,536
Gutta-percha .... "	5,175	9,829	54,345	97,728
Hides, raw :—				
Dry........... "	26,864	38,111	67,369	92,638
Wet .... "	56,771	53,500	124,886	117,551
Ivory .... "	930	790	38,177	32,773
Manure :—				
Guano .... Tons	1,774	2,045	8,125	9,714
Bones.......... "	4,512	4,776	19,315	20,309
Nitrate of soda... "	4,407	17,594	34,243	132,209
Phosphate of lime "	39,354	23,785	53,433	37,744
Paraffin.......... Cwt.	50,602	100,081	44,746	90,138
Linen rags .... Tons	1,231	1,113	12,555	10,597
Esparto .... "	14,055	12,015	57,574	48,089
Pulp of wood :—				
Chemical ...... "	15,104	14,467	102,751	110,195
Mechanical .... "	19,627	16,939	60,018	39,726
Resin............ Cwt.	226,126	166,580	47,876	40,017
Tallow and stearin "	111,445	147,847	118,079	180,433
Tar ....Barrels	27,440	38,736	21,473	28,347
Wood :—				
Hewn.......... Loads	254,983	268,013	542,209	552,728
Sawn .... "	1,140,695	997,635	2,649,484	2,455,457
Staves .... "	15,915	13,510	75,864	63,600
Mahogany ..... Tons	6,925	7,584	58,337	73,814
Other articles....Value £	..	..	977,803	1,158,935
Total value	..	..	5,706,649	5,826,760

Besides the above, drugs to the value of 90,676*l*. were imported, as against 64,180*l*. in Sept. 1898.

Exports of Drugs and Chemicals for Month ending 30th September.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali .... Cwt.	309,733	351,593	85,987	97,781
Bleaching materials "	82,092	111,281	22,418	27,144
Chemical manures Tons	54,108	33,408	207,591	193,888
Copper sulphate .. "	377	361	6,134	8,339
Medicines....... Value £	..	..	89,675	95,165
Other articles... "	..	..	260,433	270,165
Total value	..	..	672,238	692,482

Exports of Metals (other than Machinery) for Month ending 30th September.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Brass............ Cwt.	8,709	8,524	37,363	44,745
Copper :—				
Unwrought.... „	43,661	77,533	117,808	308,352
Wrought ...... „	23,059	14,692	73,999	67,133
Mixed metal... „	15,382	12,474	37,220	42,107
Cutlery ....Value £ } Hardware .... „	..	..	171,143	179,068
Implements...... „	..	..	107,765	113,831
Iron and Steel ... Tons	269,631	336,684	1,765,644	2,540,758
Lead............ „	3,883	3,455	54,481	55,361
Plated wares... Value £	..	..	39,788	37,960
Telegraph wires.. „	..	..	35,411	44,512
Tin .... Cwt.	8,365	6,803	31,578	49,259
Zinc .... „	12,181	11,749	11,033	13,537
Other articles...Value £	..	..	84,005	104,909
Total value	..	..	2,567,238	3,601,532

Export of Miscellaneous Articles for Month ending 30th September.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Gunpowder. ... Lb.	1,331,500	349,700	29,079	9,284
Military stores.. Value £	..	..	205,277	90,375
Candles......... Lb.	2,042,100	1,826,600	28,005	28,653
Caoutchouc..... Value £	..	..	118,644	123,704
Cement......... Tons	26,734	30,874	51,507	60,197
Products of coal. Value £	..	..	104,058	105,358
Earthenware ... „	..	..	124,810	152,092
Stoneware ...... „	..	..	16,542	14,616
Glass :—				
Plate .... Sq. Ft.	166,681	149,454	8,817	8,843
Flint .... Cwt.	7,983	9,913	19,916	21,657
Bottles .... „	67,350	64,668	31,459	31,731
Other kinds ... „	19,864	20,637	18,041	20,254
Leather :—				
Unwrought .... „	12,860	14,247	113,215	130,325
Wrought......Value £	..	..	42,092	46,468
Seed oil .... Tons	2,817	2,634	50,234	58,179
Floorcloth.......Sq. Yds.	1,728,000	1,970,600	77,586	88,407
Painters' materials Val. £	..	..	138,735	162,369
Paper............. Cwt.	75,103	83,018	115,181	122,390
Rags.............. Tons	4,435	5,913	23,134	32,841
Soap .... Cwt.	63,175	73,486	65,733	76,301
Total value	..	..	2,790,542	2,894,704

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, and MACHINERY.

Applications.

18,777. J. Ingleby and H. Simon, Ltd. Improvements in and relating to worm conveyors. Sept. 18.

18,920. E. Williamson. *See* Class IX.

18,957. C. T. Hennig. Calcining, roasting, or drying furnace. Sept. 20.

18,964. G. A. Herdman. Process for the production of materials for preventing the radiation or transmission of heat. Sept. 20.

19,033. F. W. Dunlap. Apparatus for evaporating and drying *in vacuo*. Sept. 21.

19,085. S. H. Emmens. Improvements in refrigerating and refrigerants. Complete Specification. Sept. 22.

19,196. A. Wall. A method of and apparatus for carbonating liquids. Sept. 23.

19,277. G. Devaux and H. Diedrich. A new or improved process of and apparatus for desiccating granular and slimy or pasty materials or the like. Complete Specification. Sept. 25.

19,321. E. Paul. Improvements relating to heaters, condensers, evaporators, and the like. Sept. 26.

19,353. I. Timar. Improved apparatus for starting crystallisation. Complete Specification. Sept. 26.

19,437. H. J. Gardiner. Improvements in or relating to the stoppering of carboys and the like. Sept. 27.

19,442. E. R. Gabbett. Apparatus for removing the solid contents of the baskets or drums of centrifugal separators or hydro-extractors. Sept. 27.

19,465. H. Korrodi. Improvements in capsules for containing compressed or liquefied gases. Complete Specification. Filed Sept. 27. Date applied for March 13, 1899, being date of application in Switzerland.

19,543. J. J. Hicks. Improvements in thermometers. Sept. 28.

19,682. F. Brand. An improved charcoal kiln. Complete Specification. Sept. 30.

19,684. C. T. Hennig. Calcining, roasting, or drying furnace. Sept. 30.

19,822. M. P. M. Collier. Improvements in or relating to the cooling of heated surfaces, spaces, objects, and the like. Oct. 3.

19,838. G. Code and H. Knudsen. Improvements relating to the liquefaction of aeriform fluids and to apparatus therefor. Complete Specification. Oct. 3.

19,856. W. Clark.—From C. F. Courtney, New South Wales. Improvements in magnetic separators. Oct. 3.

20,018. H. H. Lake.—From La Société Anonyme le Carbo Siphon, Belgium. Improvements in devices for use in the saturation of liquids with gases at high pressure. Oct. 5.

20,062. D. A. Blair, J. B. Blair, and R. Baillie. Improvements in and relating to evaporators, condensers, and the like, for producing fresh water from salt or impure water. Oct. 6.

20,202. J. Laidlaw and J. W. Macfarlane. Improvements in centrifugal machines. Oct. 9.

20,635. W. Davis-Douglas. A kiln. Filed Oct. 14. Date applied for March 18, 1899, being date of application in United States.

Complete Specifications Accepted.*

1898.

21,951. S. E. Ericson. Valve cock. Sept. 27.

22,204. W. L. Wise.—From A. Kitson, United States. Vapour-burning apparatus. Oct. 18.

22,895. A. J. Newton and W. H. Cocks. Apparatus for separating or removing sediment from liquids and for similar purposes. Oct. 11.

24,518. J. G. Davies. Apparatus for heating and cooling liquids. Oct. 11.

26,771. J. B. M. P. H. Roslin, Baron D'Ivry. Portable apparatus for the artificial production of cold. Oct. 11.

1899.

11,124. J. Mecredy. Apparatus for concentrating or drying liquid or semi-liquid substances by evaporation. Oct. 11.

14,890. M. Guttner. Centrifugal apparatus with continuous action. Oct. 18.

15,235. C. E. Tripler. Apparatus for liquefying atmospheric air and utilising the same. Sept. 27.

16,080. A. J. Boult.—From Mrs. Longuemare, France. Carburettors. Sept. 27.

16,381. W. Witkowitch. Apparatus for heating or cooling liquids, air, or gases. Oct. 18.

16,663. J. Overhoff and A. Colautti. Apparatus for cooling liquids, concentrating solutions, and the like. Oct. 4.

16,664. J. Overhoff and A. Colautti. Apparatus for cooling liquids and for concentrating solutions and the like. Oct. 4.

16,830. K. O. B. Textorius and J. J. Howard. Air-power generators or compressing apparatus for air or gas. Oct. 18.

II.—FUEL, GAS, and LIGHT.

Applications.

18,800. R. Nordmann. An improved process for the production of incandescence bodies. Sept. 18.

18,824. W. L. Voelker and The Voelker Incandescent Mantle, Ltd. Improvements in incandescent gas mantles. Sept. 18.

19,032. Siemens Brothers and Co., Ltd.—From Siemens and Halske Actien Gesellschaft, Germany. Process and apparatus for purifying gases from dust. Sept. 21.

19,036. E. Björnrüd. Acetylene gas generating and storing apparatus. Complete Specification. Sept. 21.

19,052. S. H. Berry and G. Seagrave. Improvements connected with apparatus for generating acetylene gas. Sept. 21.

19,270. A. J. Boult.—From J. E. Goldschmid, Germany. Improved method of purifying water-gas. Sept. 25.

19,275. S. C. Sörensen. An improved apparatus for generating acetylene gas. Sept. 25.

19,281. S. Koopman. The economic bright gas. Sept. 26.

19,317. J. Lewis, C. Leeson, and T. Garner. An improved illuminating gas, and apparatus for the production thereof. Sept. 26.

19,345. A. E. Adolfson. Improvements in and relating to apparatus for generating acetylene gas. Complete Specification. Sept. 26.

19,352. M. G. W. Reye. Improved process for creating large gasifying surfaces in small gasifying vessels for the production of combustible gases. Sept. 26.

19,377. P. Wigley and E. A. Arculus. Improvements in and connected with incandescent gas lamps. Sept. 26.

19,383. W. Edgar. Anti-vibrator or shock-proof device for the protection of incandescent gas mantles. Sept. 26.

19,486. F. E. Bateman. Improvements relating to incandescent gas lighting. Sept. 28.

19,545. H. Schwinning. Improved means for dispersing or reflecting light for illuminating purposes. Complete Specification. Sept. 28.

19,557. B. H. Thwaite and H. Allen. Improvements in acetylene gas generators. Sept. 29.

19,561. J. Aykroyd and B. Aykroyd. Improvements in acetylene generators and holders. Sept. 29.

19,687. C. Wülfing. Improvements in the manufacture of methane gas, or of gas mixtures chiefly containing methane. Sept. 30.

19,757. G. Hilgenstock. An improvement in coke ovens. Complete Specification. Oct. 2.

19,900. The Buffington Acetylene Gas Light Company, Ltd., and H. C. Braun. Improvements in apparatus for generating acetylene gas. Oct. 4.

20,029. J. H. H. Duncan, The New Sunlight Incandescent Company, Ltd., and H. T. Barnett. Improvements in incandescence mantles. Oct. 5.

20,048. H. J. Rogers. Improvements in apparatus for the manufacture of acetylene gas. Oct. 6.

20,097. F. P. Vallet-Rogez. An improved process and composition for facilitating the combustion of fuel. Oct. 6.

20,098. T. N. Höffding. Improvements in apparatus for generating acetylene gas. Oct. 6.

20,150. A. Hebelka. Apparatus for purifying blast-furnace gases. Complete Specification. Oct. 7.

20,167. C. K. Mills.—From G. Mallet, France. Improvements in acetylene gas generators. Oct. 7.

20,175. B. R. Adams. An improved system of illuminating with special forms of incandescent illuminators for gas. Oct. 7.

20,256. F. Ginnasi. Improvements in acetylene gas generators. Complete Specification. Oct. 9.

20,354. J. Llorens. Improvements in apparatus for generating acetylene. Complete Specification. Oct. 10.

20,378. W. Harpin. The "Abbeydale" incandescent gas fire. Oct. 11.

20,423. A. Murinick. Improved incandescence gas burner. Complete Specification. Oct. 11.

20,494. E. N. Mazza. An improved process and apparatus for separating and extracting gases from a gaseous mixture, purifying and raising gas, and increasing its illuminating power, said apparatus to be known as "Mazza's gaseous mixtures, separator, and extractor." Complete Specification. Oct. 12.

20,515. S. Falk.—From — Ahrendt, Germany. Improvements in and connected with Bunsen burners. Oct. 12.

20,567. T. H. Lewis. Improvements in devices for producing acetylene light, more especially intended for use in cycle carriage and hand lamps. Oct. 13.

20,622. P. Schreck. Improvements in acetylene gas generators. Complete Specification. Oct. 14.

20,641. W. Mackean. An improvement in incandescence gas burners. Oct. 14.

20,654. L. J. Davies. An improved fuel composition. Oct. 14.

20,658. P. Naef. Method of and apparatus for producing coke, gas, and by-products. Filed Oct. 14. Date applied for March 14, 1899, being date of application in United States.

20,659. P. Naef. Method of and apparatus for producing gas and by-products. Filed Oct. 14. Date applied for March 14, 1899, being date of application in United States.

20,660. P. Naef. Method of and apparatus for producing gas and by-products. Filed Oct. 14. Date applied for March 14, 1899, being date of application in United States.

Complete Specifications Accepted.

1898.

17,734. H. Drivet and J. Bilbie. Acetylene generators. Sept. 27.

21,691. D. J. V. Praag and F. W. Harker. Acetylene generating apparatus and the like. Sept. 27.

21,851. H. C. Jenkins and T. C. Sowden. Manufacture of "producer gas," and apparatus therefor. Oct. 18.

22,020. H. H. Lake.—From F. L. Slocum, United States. Manufacture of gas, and apparatus therefor. Oct. 4.

23,142. H. J. Dowsing. Apparatus for producing and using radiant heat. Sept. 27.

23,675. H. de Theirsant and W. A. Coulson. Generators for acetylene gas. Oct. 18.

24,585. W. Riley and A. Kershaw. Oxygen gas generators. Oct. 4.

26,238. The Economical Gas Apparatus Construction Company, Ltd., and A. Payne. Valves of apparatus for the manufacture of water and producer gas. Oct. 18.

26,665. J. Jackson. Incandescent gas burners. Oct. 18.

1899.

3102. C. J. Watts. Generator for acetylene gas. Oct. 11.

3565. M. Bernstein. Incandescent mantle for lighting purposes. Sept. 27.

8260. H. Weisz, E. Abonyi, and C. Neuberg. Preparation of ingredients and manufacture of fire lighters therewith. Oct. 18.

10,862. P. C. Saule. Apparatus for use in the generation of acetylene gas. Oct. 4.

13,924. P. Lacroix. Acetylene gas generators. Sept. 27.

14,240. E. Quelle. Apparatus adapted mainly for the manufacture of acetylene gas. Oct. 4.

15,406. L. Bartmann. Acetylene gas generators. Sept. 27.

16,036. W. B. Johnson.—From J. A. Faux, United States. Manufacture of gas. Oct. 4.

16,426. E. Hilberg. Acetylene generators. Sept. 27.

16,618. W. Knapp and R. Steilberg. Process of and apparatus for the production of compressed gas. Oct. 4.

17,888. B. E. Chollar. Method of purifying gas. Oct. 18.

18,189. C. Dewey and J. A. Chown. Device for generating acetylene gas. Oct. 18.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Applications.

18,825. G. W. Johnson.—H. Spurrier, Canada. Improvements in or connected with retorts and the like for use in destructive distillation or analogous operations. Sept. 18.

19,743. F. Schmidt. Improvements relating to the dry distillation of wood and kindred materials. Complete Specification.

Complete Specification Accepted.

1899.

2183. F. Lennard. Apparatus for the separation of free carbon from tar. Sept. 27.

IV.—COLOURING MATTERS and DYES.

Applications.

18,802. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. *See* Class XX.

18,872. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of azo colouring matters. Sept. 19.

18,900. The firm of Depetit, Dollfus, and Gansser. Improvements in the manufacture of colouring matters. Filed Sept. 19. Date applied for Feb. 20, 1899, being date of application in Italy.

18,954. O. Imray. — From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of cotton dyestuffs. Sept. 20.

18,977. B. Willcox. — From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new black substantive azo-dyes. Sept. 20.

19,531. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new anthraquinone dyestuffs. Sept. 28.

19,534. H. H. Lake. — From Farbwerke Mulheim, formerly A. Leonhardt and Co., Germany. Improvements in the manufacture of colouring matters. Sept. 28.

19,617. C. D. Abel.—From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. Sept. 29.

19,618. C. D. Abel. — From Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. Sept. 29.

19,622. F. H. Smith. New or improved azo-dyestuffs. Sept. 29.

20,102. C. K. Mills —From L. Cerf, France. Obtaining a derivative of phenol 1.2-methanolsulphonimide. Oct. 6.

20,232. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of dyestuffs containing sulphur which dye cotton direct, and materials for use therefor. Oct. 9.

20,233. J. Y. Johnson.—From Vereinigte Chininfabriken Zimmer and Co., Germany. The manufacture and production of new derivatives of quinine carboxylic acid. Oct. 9.

20,413. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of dinitro-diamido anthraflavic acid. Oct. 11.

20,485. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of dyestuffs from the intermediate product in the manufacture of naphthazarine. Oct. 12.

Complete Specifications Accepted.

1898.

23,893. G. W. Johnson.—From Kalle and Co., Germany. Manufacture of new polyazo dyestuffs. Sept. 27.

24,383. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of dyestuffs for cotton. Sept. 27.

24,538. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of blue to black sulphurous dyestuffs. Oct. 4.

25,566. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of azo-colouring matters. Oct. 18.

25,651. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of mordant-dyeing colouring matters. Sept. 27.

25,964. G. W. Johnson.—From Kalle and Co., Germany. Manufacture or preparation of paradiamidophenylamine carboxylic acid and of colouring matters therefrom. Sept. 27.

25,966. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of indigo. Oct. 18.

26,262. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of disazo colouring matters. Oct. 18.

1899.

211. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of azo colouring matters. Sept. 27.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

18,884. J. Imray.—From E. Bronnert, Germany, Improvements in the production of cellulose solutions adapted for the manufacture of threads. Sept. 19.

18,935. K. T. Sutherland. Improvements connected with the preparing or cleansing of leaf and stalk fibres or the materials made from them. Sept. 20.

19,936. R. Brandts. An improved process for mercerising cotton previous to weaving. Oct. 4.

20,011. F. C. Gärtner. Improvements in mercerising machines. Oct. 5.

20,020. W. W. Wardle. Improvements in apparatus for drying yarn in hanks. Oct. 5.

20,092. C. Henry. Improvements in the process of treating silk or the like for the purpose of securing the constancy of animal heat and increasing the cutaneous vaporization and the heating power of wool. Oct. 6.

Complete Specifications Accepted.

1898.

17,549. A. Millar. Producing fabrics or tissues. Sept. 27.

24,784. J. H. Wood. Apparatus for mercerising woven fabrics. Oct. 18.

1899.

15,729. H. Krantz. Apparatus for use in stretching, drying, and carbonising fabrics and the like. Oct. 11.

16,669. A. Matitsch. Manufacture of lace. Oct. 4.

16,730. W. Mather. Treatment of textile materials with liquids, vapours, or gases, and apparatus for that purpose. Oct 11.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, and BLEACHING.

Applications.

19,159. Starkey Bros., Ltd., and F. Hinchliffe. Improvements in and appertaining to machines for dyeing or treating wool and like fibres. Sept. 23.

19,365. J. O. O'Brien, of the firm of W. P. Thompson and Co.—From H. L'Huillier, France. Improvements in apparatus for dyeing fibrous materials. Sept. 26.

20,229. R. J. Yarnold. Improvements in the method or means of bleaching fibrous materials. Oct. 9.

20,344. L. Holub. Improvements in or relating to apparatus for use in the dyeing, impregnation, and like treatment of paper. Complete Specification. Oct. 10.

20,488. T. Pratt and J. W. A. Burgess. An improved mechanical device for mercerising, bleaching, and dyeing cotton and other similar warps. Oct. 12.

20,643. F. Dommer. A process for photographic reproduction of patterns, designs, or pictures on fabrics and other suitable substances by the application of mordants, lyes, and the like. Oct. 14.

Complete Specification Accepted.

1899.

16,730. W. Mather. *See* Class V.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

18,897. G. Glock. An improved process of manufacturing nitric acid. Sept. 19.

19,120. P. Imhoff, J. Raschen, and The United Alkali Company, Ltd. Improvements in the manufacture of chlorates. Sept. 22.

19,257. C. E. L. Mengelberg. Calcium carbide in a plastic form, and process for producing the same. Sept. 25.

19,762. B. Willcox.—From The Badische Anilin und Soda Fabrik, Germany. Improvements in the manufacture of hydrosulphites and the production of solid sodium hydrosulphite. Oct. 2.

19,834. H. Baker and E. Haworth. Improvements in and connected with the production of pure salts. Oct. 3.

20,001. E. J. Duff and The United Alkali Company, Ltd. Improvements in or connected with wash towers for treating producer gases. Oct. 5.

20,384. C. C. Moore. Improvements in or relating to the production of boracic acid and other products. Oct. 11.

Complete Specifications Accepted.

1898.

20,356. S. Pitt.—From G. Laureau, Son, and Co., France. Preservation and treatment of kelp for the extraction of iodine and of gelatinous matter, and the employment of the latter for waterproofing fabrics, paper, leather, wood, and the like. Sept. 27.

20,357. S. Pitt.—From G. Laureau, Son, and Co., France. Extraction and utilisation of gelatinous matter and cellulose from marine plants, the treatment of the liquors obtained, and the apparatus employed therefor. Sept. 27.

25,020. A. Goldschmidt. Production or treatment of bichromate of soda. Oct. 18.

25,027. H. H. Lake.—From La Société Bonnet, Ramel, Savigny, Giraud, et Marnas, France. Manufacture of baryta. Sept. 27.

25,748. M. Muspratt, E. S. Smith, and The United Alkali Company, Ltd. Manufacture of hypochlorite of soda. Sept. 27.

25,925. M. Muspratt, E. S. Smith, and The United Alkali Company, Ltd. Manufacture of hydrochlorite of soda. Sept 27.

25,962. E. S. Smith and The United Alkali Company, Ltd. Manufacture of solutions of hypochlorites of alkalis. Sept. 27.

25,963. C. L. Higgins, M. Muspratt, E. S. Smith, and The United Alkali Company, Ltd. Manufacture of solutions of hypochlorites of alkalis. Sept. 27.

26,777. G. N. Vis. Process for the purification of brine. Sept. 27.

1899.

16,128. H. L. Hartenstein. Process of manufacturing metallic carbides. Oct. 4.

18,263. F. Schmidt. Production of a carbon specially suitable for use in the manufacture of calcium carbide. Oct. 18.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

19,113. F. W. Mason. Improvements in the manufacture of blocks or tiles for ornamental paving, window, wall, or ceiling decoration, and similar purposes. Sept. 22.

19,125. W. Skaife. Improvements in machinery for treating materials for use in making pottery and the like. Sept. 22.

19,756. D. Gilles. An improved method of polishing glass plates by means of grindstones. Oct. 2.

19,881. A. J. Davis. Improvements in or connected with the roughened or grip surface of glass. Oct. 4.

19,958. J. Noad and T. H. L. Bake. Improvements in glazing or enamelling compounds. Oct. 5.

20,275. B. Robinson. Improvements in machines for and method of making "saggars" and the like. Oct. 10.

20,661. La Société Anonyme de Commentry-Fourchambault et Decazeville. Improvements relating to the combining of glass with nickel steel. Filed Oct. 14. Date applied for March 28, 1899, being date of application in France.

Complete Specifications Accepted.

1898.

21,001. H. Sturm. Furnaces and drying apparatus having a movable bed for ceramic and other products. Oct. 4.

23,724. F. Mountford and The corporate body trading as B. Dellagana and Co., Ltd. Means, and their manufacture, for effecting the coloured decoration of pottery. Oct. 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

18,787. W. Owen. Improvements in or relating to the manufacture of artificial stone. Complete Specification. Sept. 18.

18,809. W. Schwarz. Improved process of preparing the raw materials for the manufacture of calcareous sandstone. Sept. 18.

18,920. E. Williamson. A new process for drying powdered granular materials. Sept. 20.

18,945. G. J. Gruendler. Improvements in building material. Complete Specification. Sept. 20.

18,958. C. T. Hennig. An improved process for freeing chalk, clay, or similar material from flints, stones, or gritty substances. Sept. 20.

19,168. H. R. Vaughan. Improvements in continuous burning kilns for burning bricks and other clay goods, and also for limes and cements. Complete Specification. Sept. 23.

19,358. C. J. R. Le Mesurier. Improved steel and other paving made of moss litter or peat, or both. Sept. 26.

19,362. G. F. Lebioda. Improvements in apparatus for impregnating long pieces of wood. Complete Specification. Sept. 26.

20,139. A. Catkosinski and L. Weintraub. Improvements in the manufacture of bricks, tiles, artificial stone, and the like. Complete Specification. Oct. 7.

20,347. H. A. Pryor.—From J. E. Summers, United States. Improvements in the manufacture of artificial marble and stone. Oct. 10.

20,377. E. W. Beech. Improvements in the construction and formation of building bricks. Oct. 11.

20,387. F. Sehr. Improvements in or relating to the manufacture of cement. Oct. 11.

20,518. S. Weill. Process for the production of artificial marble. Complete Specification. Oct. 13.

Complete Specifications Accepted.

1898.

21,584. E. Homan. Fireproof floors, ceilings, or the like. Oct. 11.

22,242. G. A. Keifer. Manufacture of artificial stone. Sept. 27.

23,508. T. Potter. Construction of fireproof buildings. Oct. 4.

24,629. A. E. Alexander.—From D. W. Peek, United States. Process for producing artificial asphalt. Oct. 4.

24,630. A. E. Alexander.—From D. W. Peek, United States. Process for producing artificial asphalt. Oct. 4.

27,008. C. F. A. E. H. von Forell. Manufacture of cement, and apparatus therefor. Oct. 11.

1899.

12,871. W. Borgolte, sen. Manufacture of cement. Oct. 18.

13,238. G. X. Dime. Fireproofing composition. Oct. 4.

16,822. G. Liebau. Fireproof floors and ceilings. Sept. 27.

18,164. G. Davies.—From J. Fender, United States. Fire-proof floor construction. Oct. 18.

X.—METALLURGY, MINING, Etc.

Applications.

18,960. K. A. Cooke. Improvements relating to the coating of iron or steel with copper or its alloys. Sept. 20.

19,021. J. Baxeres de Alzugaray. Improvements in and connected with the manufacturing of metallic alloys. Sept. 21.

19,038. W. J. Foster. Improvements in reheating furnaces or soaking pits for treating iron or steel preparatory to rolling or forging same. Sept. 21.

19,093. W. B. Johnson.—From J. S. Unger, United States. Improvements in carburising armour plates. Complete Specification. Sept. 22.

19,171. The Golden Link Consolidated Gold Mines, Ltd., and H. J. Phillips. Improvements in or relating to the extraction of precious metals from certain of their ores. Sept. 23.

19,466. E. Petersson. Improvements in the treatment of sulphurous ores containing arsenic, antimony, or tellurium. Sept. 27.

19,468. H. Frank. Improved casting process and apparatus therefor. Sept. 27.

20,000. T. K. Bellis and T. Andrew. Improvements in the manufacture and tempering of steel and finished articles made thereof, and the appliances necessary for its production. Oct. 5.

20,293. W. A. Thoms and G. W. Thomas. An improvement in coating metals and metallic alloys. Oct. 10.

20,583. H. H. Lake.—From M. Costello, United States. Improvements in and relating to the treatment of ores or the like for determining the presence of gold therein. Oct. 13.

20,656. F. Ellershausen. Improvements in the treatment of condensed fumes containing lead and zinc compounds. Oct. 14.

20,661. La Société Anonyme de Commentry-Fourchambault et Decazeville. *See* Class VIII.

Complete Specifications Accepted.

1898.

21,387. R. B. Thomas and H. S. Thomas. Manufacture of tin and terne plates and other like metal-coated plates or sheets, and apparatus employed in the said manufacture. Oct. 4.

21,395. J. B. de Alzugaray. Extraction of gold, silver, and other metals from ores and the like. Oct. 11.

21,948. F. E. Elmore. Separating metallic from rocky constituents of ores, and apparatus therefor. Oct. 18.

23,221. G. De Bechi. Treatment of complex ores. Oct. 11.

24,749. W. Ivanoff. Manufacture of iron and steel directly from ores, and apparatus therefor. Oct. 11.

25,477. C. L. C. Bertou. Process of treatment of lead, tin, copper, and other metals or metallic alloys with a view to prepare oxides in a pulverulent state. Oct. 4.

26,393. T. C. Van de Stadt. Soldering or brazing aluminium. Oct. 18.

1899.

4925. F. W. Martino and F. Stubbs. Treatment of ores and the precipitation of precious metals from their cyanide solutions. Oct. 4.

5034. F. W. Martino and F. Stubbs. Precipitation of gold from chlorine or bromide solutions containing it. Oct. 4.

14,226. A. G. Brookes and P. Aulich, Germany. Process of manufacture of aluminium and magnesium alloys. Sept. 27.

14,686. O. P. Nauhardt. *See* Class XIII.

15,129. J. Zerzog. Process of enamelling iron and other metals. Sept. 27.

XI.—ELECTRO-CHEMISTRY and ELECTRO-METALLURGY.

Applications.

18,870. A. J. Boult.—From J. Jungbluth, Germany. Improved manufacture of insulating material. Complete Specification. Sept. 19.

19,105. P. A. Chalas. Improvements in secondary batteries. Sept. 22.

19,112. C. F. P. Stendebach and H. M. F. Reitz. Improved filling mass or active material for the production of solid accumulator plates. Complete Specification. Sept. 22.

19,825. H. J. Sheldon. Improvements for rendering moulds conducting in the electrolytic bath. Oct. 3.

20,110. F. Loppé, H. P. Morin, D. P. Martin, and G. J. A. Griner. Improvements in electrical accumulators. Filed Oct. 6. Date applied for April 1, 1899, being date of application in France.

20,151. A. Webb. Improvements in and connected with electric accumulator and battery boxes. Oct. 7.

20,214. A. A. Vogelsang. Improvements in or connected with electrolytic bleaching of baled yarns. Oct. 9.

20,237. L. Bourdillon. Improved manufacture of articles plated with platinum, gold, and silver by electrolysis, and apparatus therefor. Complete Specification. Oct. 9.

20,471. A. J. Boult.—From P. Delafon, France. Improvements in or relating to electric batteries. Complete Specification. Oct. 12.

20,504. C. A. Sahlstrom. Improvements in batteries or apparatus for producing ozone. Oct. 12.

Complete Specifications Accepted.

1898.

14,714. D. Martini. Vacuum dielectrics, electrodes, and apparatus for the production of ozone. Oct. 18.

21,974. S. O. Cowper-Coles. Electro-deposition of metals. Oct. 18.

22,115. E. Baresch, R. M. A. Baresch, E. M. Tosler, and W. von Zabern. Galvanic batteries. Oct. 4.

1899.

2629. R. J. Yarnold. Electrolysis or modification of gases and gaseous mixtures or compounds. Sept. 6.

5199. T. J. Holland and A. P. Laurie. Electrolytic decomposing apparatus. Oct. 4.

5200. T. J. Holland and A. P. Laurie. Manufacture of porous diaphragms for electrolytic apparatus. Sept. 27.

7321. W. A. Gent. Secondary battery plates, grids, and the like. Oct. 11.

11,717. A. E. Hodgson. Electric batteries. Sept. 27.

15,426. A. Tribelhorn. Electric battery, and process for constructing the electrodes for the same. Sept. 27.

15,438. E. Frenot. Electrolytic process and apparatus for the production of chemically pure cupric sulphate and copper. Sept. 27.

16,247. A. Smith. Material adapted for electrical insulation, and also for many purposes for which ebonite, wood, and such like materials are used. Oct. 4.

16,555. F. A. Gooch. Reduction of aluminium by electrolysis. Sept. 20.

16,636. E. Placet. Electrical accumulator batteries. Oct. 11.

XII.—FATS, OILS, AND SOAP.

Applications.

20,525. W. E. Heys.—From J. Zibell and the firm of J. Zibell and Co., Austria. Improvements in and connected with the production of vaseline and vaseline oil. Oct. 13.

Complete Specifications Accepted.

1898.

24,375. C. Dreher. Manufacture or production of resin soap. Sept. 27.

24,740. G. Mitchell. Process and apparatus for extracting oil from seeds, nuts, beans, and the like. Sept. 27.

1899.

12,236. W. P. Thompson.—From M. Novaretti, Italy. Apparatus for purifying engine lubricating oil and the like. Sept. 27.

17,012. A. Euston. Apparatus for treating oleaginous seeds. Oct. 11.

17,013. A. Euston. Hydraulic presses particularly adapted for extracting oil from oleaginous seeds. Oct. 4.

17,014. A. Euston. Hydraulic press for extracting oil from oleaginous seeds. Oct. 11.

17,685. F. Treu. Oil purifiers. Oct. 11.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

Applications.

19,361. A. E. Lefebvre. Improved preservative fluid or paint. Complete Specification. Sept. 26.

19,464. H. Schneider. Process for manufacturing a substitute for gutta-percha for coating cables and for other purposes. Complete Specification. Sept. 27.

20,224. T. J. O'Sullivan. Process of making pigments. Filed Oct. 9. Date applied for March 10, 1899, being date of application in United States.

Complete Specifications Accepted.

1898.

24,932. A. Nevin and T. Bulfield. Composition for distempering or painting. Oct. 4.

1899.

21,538. J. G. Deiss. Process for extracting india-rubber or gutta-percha from vegetables which contain them. Aug. 30.

14,068. R. W. James.—From G. D. Coleman, United States. Method of and means for the application of antifouling coating for the wooden surfaces of submerged structures. Sept. 27.

14,686. O. P. Nauhardt. Special varnish for aluminium. Sept. 27.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

Applications.

19,540. B. Trenckmann. Improvements in leather manufactured from the intestinal coat of animals, and in gloves made from such leather. Complete Specification. Sept. 28.

20,503. C. A. Sahlstrom. Improvements in the process of tanning hides, skins, and the like. Oct. 12.

20,569. F. S. D. Scott. Improvements in imitation leather materials and the like. Oct. 13.

Complete Specifications Accepted.

1898.

24,844. J. V. Koch. Tanning. Oct. 18.

XV.—AGRICULTURE AND MANURES.

Application.

18,817. H. A. Cohu and E. Geisenberger. Process and apparatus for fixing the nitrogen of the air. Filed Sept. 18. Date applied for March 3, 1899, being date of application in France.

XVI.—SUGARS, STARCHES, GUMS, Etc.

Applications.

20,355. H. Flesche, of the firm "Actien-Gesellschaft für Verzinkerei und Eisen-Construction vormals Jacob Hilgers." Improved process of manufacturing crystallized sugar or sugar candy and apparatus therefor. Complete Specification. Oct. 10.

20,405. W. J. Engledue. Improvements in or relating to the refining of sugar. Oct. 11.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

18,944. G. Kreutzer and J. Schmitz. Process and brewery apparatus for the continuous production of beer with three chief vessels while making use of the Schmitz brewing process. Sept. 20.

19,044. J. House and H. S. Russell. Improvements in brewing apparatus. Sept. 21.

19,518. R. Cunliffe and H. Forshaw. Improvements in machines for drying brewers' refuse and other materials and substances. Sept. 28.

19,735. F. M. Maynard. Improvements in settings of brewers' and other coppers and pans heated by direct fire. Oct. 2.

Complete Specifications Accepted.

1899.

13,245. J. Topf. Kilns for drying malt. Oct. 11.

15,030. R. Fullnicht. Process for solidifying spirits Oct. 18.

16,443. F. Thatcher. Brewers' and distillers' wort. Oct. 11.

XVIII.—FOODS, SANITATION, Etc., AND DISINFECTANTS.

Applications.

A.—Foods.

18,791. A. Roubleff. An improvement in coffee substitutes. Sept. 18.

18,798. H. J. Blackler and W. T. Burgess. Improvements in apparatus and method for the preparation of artificial human milk. Sept. 18.

18,816. J. D. Coakley. An elastic antiseptic or preservative coating for fruit, eggs, and other perishable goods. Sept. 18.

18,821. W. Schwartz. Improvements in animal food. Sept. 18.

19,698. F. J. F. von Mering. Improvements in and relating to the treatment and utilisation of milk. Sept. 30.

19,802. J. H. Kellogg. Improvements in processes for preparing cereal cakes. Complete Specification. Oct. 3.

19,972. G. Bamberg. Improvements in manufacturing tablets of food beverages. Oct. 5.

20,330. J. R. Croft and H. A. Hobson. Improvements in the preservation of alimentary substances. Oct. 10.

20,626. C. Janson. Improved preparation of sterilised milk powder. Complete Specification. Oct. 14.

B.—Sanitation.

19,129. H. McPhail. Improvements in and relating to the treatment of pot-ales, spent lyes, wash, liquors, sewage, and other aqueous by-products or refuse. Sept. 22.

19,197. J. Brightmore, T. Swann, and F. S. Goodwin. Improvements in the bacterial treatment of sewage and effluents from sewage works. Sept. 23.

19,379. J. O. Kröhnke. An improved method of purifying water. Complete Specification. Sept. 26.

19,411. E. W. Ives. Improvements in the method of and apparatus for the treatment of sewage and like liquids. Complete Specification. Sept. 27.

20,443. J. Bardsley. Improved method and means of reclaiming waste liquors. Oct. 12.

Complete Specifications Accepted.

A.—Foods.

1898.

21,971. E. Frichot. Process for sterilising and blanching cereals and alimentary leguminous substances. Oct. 11.

23,637. M. Julien. Process and apparatus for treating butter for purposes of conservation and subsequent restoration to the fresh condition. Sept. 27.

24,403. M. Marx. Preserving eggs. Sept. 27.

25,401 A. M. Clark. — From F. Dippel, Germany. Method of preserving eggs, fruit, and eatables in general. Oct. 4.

26,568. H. Ballantyne. Food preparations. Oct. 11.

27,246. M. Dietrich. Food from blood. Sept. 27.

1899.

1990. M. Stockham. Coffee substitute without the inclusion of chicory. Oct. 4.

11,659. C. J. Dick. Fruit and vegetable vapour preservation process. Oct. 4.

16,966. B. Endler. Method of preserving eggs. Oct. 11.

17,145. A. Gürber. Process for producing condensed milk. Oct. 11.

B.—Sanitation.

1898.

21,288. W. J. Wright. Water softening and purifying apparatus. Sept. 27.

21,289. W. J. Wright. Water heating and purifying apparatus. Oct. 4.

21,777. J. W. Baker. Apparatus for softening and clarifying water. Oct. 4.

25,000. W. P. Thompson.—From C. G. Gsell, Germany. Process for purifying waste water or sewage by precipitation. Oct. 11.

1899.

15,784. P. Schreck. Water purifiers. Oct. 4.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

19,207. W. C. L. Holland. A method of rendering books non-inflammable. Sept. 25.

19,541. P. S. Sinclair. Improvements in conduits in paper-making apparatus for conveying the stuff or pulp. Complete Specification. Filed Sept. 28. Date applied for March 4, 1899, being date of application in United States.

20,279. J. Chaubet. Improved composition for the manufacture of celluloid. Oct. 10.

20,630. M. Fremery and J. Urban. Improvements in and relating to the drying of cellulose products. Oct. 14.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Applications.

18,802. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of carbamic ethers. Sept. 18.

19,413. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. Improvements in the manufacture or preparation of alkylised uric acid. Complete Specification. Sept. 27.

19,629. H. H. Lake.—From chemical work, formerly Sandoz, Switzerland. Improvements in the manufacture of saccharine. Sept. 29.

Complete Specifications Accepted.

1898.

13,688. J. E. T. Woods. Manufacture of artificial camphor from hydrocarbon oils of the terpene series. Sept. 27.

1899.

75. C. D. Abel.—From The Actiengesellschaft für Anilin Fabrikation, Germany. Manufacture of an aromatic ether. Oct. 11.

16,231. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. Manufacture or preparation of derivatives of 3^1-hydroxycaffeine. Oct. 4.

XXI.—PHOTOGRAPHY.

Applications.

19,363. R. Widmann. An improved process for producing stippled or grained photographic pictures directly from photographic negatives or diapositives. Sept. 26.

19,843. L. A. Garchey. Improvements in colour photography. Oct. 3.

Complete Specifications Accepted.

1899.

17,098. J. Meyer. Process of producing photographic films. Oct. 18.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

18,810. R. Voeglin and S. Schimpf. Improvements in or relating to matches. Sept. 18.

19,544. V. von Neumann. Improvements in detonators for railway signalling. Sept. 28.

19,695. Sir W. G. Armstrong, Whitworth, and Co., Ltd., and G. Stuart. Improvements in time fuses. Sept. 30.

Complete Specifications Accepted.

1898.

19,806. E. Hollings. Moulding or forming into blocks or the like, gun-cotton or similar materials. Sept. 27.

24,468. E. A. G. Street. Explosives. Sept. 27.

25,102. R. E. A. Gans. Manufacture of ignition material for matches and other purposes. Oct. 4.

1899.

6523. C. H. Curtis, C. L. W. Smith, Dr. J. Metcalfe, A. C. Pearcy, and A. F. Hargreaves. Manufacture of Gunpowder. Oct. 4.

10,865. L. Purgotti and A. Purgotti. Employ of the cupreous rhodanate in the manufacturing of matches of whatever kind. Oct. 4.

12,392. F. J. W. Lindeman. Manufacture of explosives. Sept. 27.

13,232. H. P. Hurst. High explosive projectiles and detonating fuses, and attachments or fittings therefor. Sept. 27.

XXIII.—ANALYTICAL CHEMISTRY.

Complete Specification Accepted.

1899.

14,029. V. Durant. Process for analysing milk, milk products, and other fatty, solid, or liquid matters, and apparatus therefor. Sept. 27.

Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—p. 8068.

THE JOURNAL

OF THE

Society of Chemical Industry.

A MONTHLY RECORD

FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 11.—Vol. XVIII.] NOVEMBER 30, 1899. [Non-Members 30/- per annum; Members 21/- per Set of extra or back numbers; Single Copies (Members only) 2/6.

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SESSION 1899—1900.

Monday, Dec. 4th.—Mr. Sherard Cowper-Coles, Assoc. M.I.C.E., M.I.M.E., M.I.E.E. "The Fireproofing and Preserving of Timber."

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Friday, Dec. 1st :
Dr. A. K. Miller and Mr. Percy Potts. "Notes upon the Analyses of some Sugar Syrups."
Mr. T. Aspinall. "Oxidation of Organic Matter by Liquid Chlorine."

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SESSION 1899—1900.

Tuesday, Dec. 19th (Glasgow) :—
Mr. Alfred Cluddey. "The Cyanide Process at Yalwal, N.S.W."
Dr. Jno. Clark. "A Method for the Analysis of Copper."

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NOTICES.

Foreign and Colonial Members are reminded that the subscription of 25*s.* for 1900, payable on January 1st next, should be sent in good time to the Treasurer (Mr. Samuel Hall), in order to ensure continuity in the receipt of the Society's Journal. Any changes of address to appear in the new List of Members now in course of preparation, should reach the General Secretary not later than January 15th, 1900.

COLLECTIVE INDEX.

The Collective Index (1881—1895) is now ready. The prices are as follows:—

To Members and Past Members; Libraries, Societies, and Exchanges on the Society's List	Each copy 10*s.*
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EXCURSION TO PARIS.

As arranged at Newcastle in July last, it is proposed to hold the next Annual General Meeting in London, and then to adjourn to Paris. The visit will be so timed as to coincide with the Meeting of the International Congress of Applied Chemistry, which will be held in Paris from the 23rd to the 31st July, and to which the Council has agreed to send delegates. It will also afford an excellent opportunity of visiting the International Exhibition. Ladies may accompany members as usual upon such occasions.

Having regard to the large numbers who are expected to visit Paris next summer, it is imperatively necessary to secure hotel accommodation some months beforehand; and in order to do this, the Council must have some indication of the numbers for which it would have to provide.

When data have been obtained from which some estimate of the cost may be made, the Council will communicate further with those who fill up and return the form, issued with the October number, to the General Secretary. This should be done at once.

Notice is hereby given, for the information of members and advertisers, that the advertisement columns of this Journal have been contracted for by Messrs. EYRE and SPOTTISWOODE, the Society's printers and publishers, to whom all communications respecting them should be addressed. The circulation of the Journal is now more than 3,500 per month.

LIST OF MEMBERS ELECTED 23rd NOVEMBER 1899.

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Crombie, J. A., 1105, Metropolitan Avenue, Brooklyn, N.Y., U.S.A., Essential Oils Manufacturer.

French, Alfred, The County Hospital, York, Dispenser.

Goodhue, F. A., 32, India Street, Boston, Mass., U.S.A., Aniline Colour Importer.

Haenlein, Dr. F. H., Director der Deutscher Gerberschüle, Freiberg, Saxony, Leather Chemist.

Haus, Simon V., c/o Nepera Chemical Company, Nepera Park, N.Y., U.S.A., Photographic Chemist.

Hoskins, Wm., Room 55, 81, South Clark Street, Chicago, Ills., U.S.A., Chemist.

Liedbeck, P. F. Alarik, Stockholm, Sweden, Chemical Engineer.

Matthews, Dr. J. Merritt, 634, Spruce Street, Philadelphia, Pa., U.S.A., Professor of Chemistry and Dyeing.

Nihoul, Dr. Edw., Waremme, Belgium, Professor of Leather Industries.

Norris, Geo. L., Standard Steel Works, Burnham, Mifflin Co., Pa., U.S.A., Chemist.

Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.

Pirie, Alex. G., Alex. Pirie and Sons, Ltd., Stoneywood Works, Bucksburn, Aberdeenshire, Paper Manufacturer.

Pizey, Jas. H., 9, Lady Somerset Road, Highgate Road, London, N., Chemist.

Sholes, Chas. E., c/o General Chemical Company, 32, Liberty Street, New York, U.S.A., Chemical Salesman.

Tiemann, Hugh P., 530, West 123rd Street, New York City, U.S.A., Student.

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Whitaker, Milton C., Department of Chemistry, Columbia University, New York, U.S.A., Tutor in Chemistry.

CHANGES OF ADDRESS.

Ablett, A. W., l/o Johannesburg; Salvador Mines, Ltd., Santa Rosa, Salvador, Central America.

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McMurtry, G. C., l/o Wallaroo; Copper Smelting Works, Lithgow, N.S.W.

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Neale, Harry A.; Journals to Brentwood, Clothorn Road, Didsbury, Manchester.

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Pollock, Dr. F., l/o Hermitage Road; 17, Woodland Street, Crumpsall, Manchester.

Pullar, Sir Robt.; Journals to J. Minto, Sandeman Public Library, Perth.
Roller, H. C., l/o New York; c/o Dick Ridout and Co., Cobourg, Ont., Canada.
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Shimosé, M.; Journals to Shimosé Powder Works, Takinogawa, near Oji, Tokio, Japan.
Smith, Harry, l/o Falconer Street; 74, Fairfield Road, West Jesmond, Newcastle-on-Tyne.
Stock, F. W. Keating, l/o Birchfield; County Analyst's Office, Darlington.
Wakefield, Wm. C., l/o Burton-on-Trent; Liverpool Road, Ditton, Widnes, Chemist.
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CHANGE OF ADDRESS REQUIRED.

Eastick, S. P., l/o 4 and 5, Warwick Court, Holborn, W.C.

LIST OF MEMBERS ELECTED 23rd OCTOBER 1899.

ERRATUM.

Arnolt, G. W. Campbell: for "Arnolt" read "Arnott."

MEMBER OMITTED FROM LIST.

Aspinall, Thos., 42, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.

Deaths.

Moore, B. T., M. Inst. C.E., Longwood, Bexley, Kent. Nov. 15.
Pielsticker, C. M., Kingsmead, Wembley, Middlesex.
Wilcox, Henry, Stanford-le-Hope, Essex. Oct. 17.
Williams, W. Lloyd, Phœnix Mills, Dartford, Kent. Oct. 29.

London Section.

Meeting held on Monday, November 6th, 1889.

MR. OTTO HEHNER IN THE CHAIR.

Before proceeding to the ordinary business, the Chairman said that it was his duty to refer to two cases of death that had occurred since their last meeting, whereby chemistry, both pure and applied, had lost two of its most illustrious representatives—Robert William Bunsen and Edward Frankland. It was a remarkable and sad coincidence that those two men—the aged and venerable teacher on the one hand, and the brilliant and illustrious pupil on the other—should have died within a few days of each other. No words of his were needed to recall to the members the immense service which these two men had rendered in the development of the science they all had at heart. He might remind them, however, with regard to Bunsen, who died in Heidelberg at the age of 88, that his name had been a household word for nearly 60 years, he having as early as 1840 made epoch-making contributions to chemistry, viz., to the elucidation of those interesting organo-metallic compounds, the kakodyl bodies, to which class of substance his pupil, Frankland, added so many new members, opening up by his labours a wide new field of research; how, somewhat later, Bunsen laid the foundation of accurate gas analytical methods, and Bunsen's methods still remained the standard of perfection in gas volumetric analysis; how he gave to the world the battery which bears his name, and which enabled him to prepare, more readily and in larger amount than had been possible before, aluminium, lithium, barium, strontium, &c., by electrolysis of their chlorides. About the middle of the century, he elaborated that extended branch of analytical methods founded on the measurement of iodine. The Bunsen burner, the Bunsen pump, the Bunsen photometer, the Bunsen valve, and his ice calorimeter, were familiar to all, and showed the practical bend of his mind.

But in collaboration with Kirchoff he rendered his greatest service to mankind: the elucidation of the meaning of the Fraunhofer lines in the solar spectrum, and the elaboration of spectroscopy. Caesium and rubidium were the first fruits, to which in later years other observers had added so many others. To the chemist, physicist, and astronomer alike, the spectroscope gave an engine of immense value.

The services to science of Bunsen's pupil and friend, Frankland, who had been so lately among them, and had been the teacher of so many of those present, need not be recalled. They had all loved, respected, and revered the man; how much he had contributed to their knowledge, and how much he had influenced the direction and current of thought in the domain of modern organic chemistry, they were aware. Without him the development and progress of organic chemistry as it now was would not have taken place. To him we owed the idea of valency, upon which modern chemistry was built. Apart from his strictly scientific worth, his services to this country in connection with water supply would long be remembered, and the blue-books which contained the reports of the Rivers' Pollution Commissions were patterns of laborious and fruitful work.

The names of Bunsen and Frankland would live in the hearts not only of those who knew them personally, and not only of those who valued science for its own sake, but of those who applied their knowledge of industrial purposes.

"VELVRIL" MATERIAL: A NEW SUBSTITUTE FOR INDIA-RUBBER AND GUTTA-PERCHA.

BY W. F. REID, F.I.C., F.C.S.

AMONG the many products of the vegetable world that have been produced artificially in the laboratory none is more interesting than india-rubber. There appears to be little doubt that Dr. Tilden obtained a small quantity of real india-rubber from isoprene; but subsequent experiments do not seem to have been so successful, and we are still dependent upon vegetation in the tropical regions for our supply of that useful material. There are several plants growing in temperate climates, even in our own, which contain a considerable proportion of india-rubber, and, with the example of the sugar industry before us, we need not despair of producing india-rubber as a field crop should the necessity for doing so arise. Some attempts have been made to start india-rubber plantations and Para rubber trees have been established in most British possessions where the climate is suitable; but very little india-rubber from these sources comes into the market. So far, the production of india-rubber has almost been able to keep pace with the demand, but the consumption is increasing so rapidly that we appear to be approaching a critical stage. The increase in the exports of india-rubber from Para, for instance, was more than 3,000 tons last year, the total exports from that port being 25,248 tons. Dr. Morris estimates the world's consumption of india-rubber at 60,000 tons per annum, of the value of about 15,000,000*l*. In South America alone, the area that is known to produce Para rubber amounts to at least 1,000,000 square miles, and at first sight the supply would, therefore, appear to be assured for a long time to come. But those who have had to cut their way through these dense forests know only too well that the price of the product must rise very considerably before it will pay to collect it at any distance from the rivers which there form the only means of communication. New tropical regions are continually being opened up, and sources of india-rubber found which were not previously suspected, so that on the whole, perhaps, we need not be unduly alarmed as to the supply in the immediate future.

In the case of gutta-percha, however, the position is not so favourable. It is found only in a limited area, and the process of extraction has hitherto been destructive to the trees. Newer processes of extracting from the leaves are being tried, but their commercial success depends upon so many different conditions that it is doubtful if they will materially affect the production for many years to come. The quantity of gutta percha exported from Singapore annually is now about 2,600 tons. When we remember that gutta-percha is absolutely necessary for the insulation of deep sea cables and that the best quality only is suitable for that purpose the question of a sufficient supply of this or some equally good material becomes one of the greatest importance to all civilised nations. The last cable from Brest to New York, for instance, consumed 550 tons of gutta-percha of the best quality.

Without going further into statistics of these two materials I think the figures given will be enough to show that even if there be no cause for anxiety as to a sufficient supply during the next few years, yet it would be a distinct advantage if substances could be found that would replace india-rubber or gutta-percha in at least some of their applications and thus prevent the demand overtaking the supply too rapidly. With this object in view I have been carrying out a number of experiments for several years, and you now see before you some of the products of the industry to which those experiments have given rise. The basis of the new material is a drying or semi-drying oil which is nitrated by strong nitric acid. A nitro-compound is formed containing from 4 to 5 per cent. of nitrogen, and this is thoroughly purified until all traces of free nitric acid are removed. In practice, the oils used are linseed oil and castor oil, and, owing to the unstable nature of linseed oil, castor oil is preferred. Most of the materials shown here are made with nitroricinolein derived from castor oil. The other ingredient used is a nitro-cellulose of a very low degree of nitration. The treatment with nitric acid modifies the properties of these oils in several important respects. The specific gravity of linseed oil, for instance, rises from 0·935 to 1·112, and of castor oil from 0·967 to 1·127. While castor oil is miscible in any proportion with carbon di-sulphide that solvent has scarcely any action upon nitroricinolein. There are a number of other reactions which interest the chemist; but the one of most technical importance is the property possessed by these nitro-compounds of forming a homogeneous mass with nitro-cellulose. When linseed or castor oil is mixed with a solution of nitro-cellulose in a suitable solvent and the solution evaporated, the oil, unless present in very small quantity only will separate from the nitro-cellulose, the mass obtained being a brittle spongy material enclosing the oil in its pores. The percentage of castor oil that may be mixed without separation in this way is greater than that of linseed oil; but does not exceed 5 per cent. The nitrated oils, on the contrary, may be mixed in any proportion with nitro-cellulose and form a clear, homogeneous mass upon the evaporation of the solvent. A material somewhat similar in appearance may be obtained with various liquid nitro compounds such as nitro-glycerine, nitro-benzene, nitro-toluol, &c., and the late Alfred Nobel proposed to use several such mixtures as substitutes for india-rubber; but, probably owing to their inflammable, in some cases even explosive, nature none of these have come into use. The admixture of other substances to diminish the inflammability is not possible because these substances would have to be added in such large quantities that they would materially affect the useful qualities of the product. The inflammability of the "velvril" materials is about the same as that of india-rubber or gutta-percha, as you will see when I light this piece of "velvril" cord. You will also notice that it is easily extinguished, even when well alight. The mass swells up while burning, and leaves a spongy, carbonaceous substance. The smell evolved is strong and characteristic. The "slowing" action of the nitrated oils is very remarkable, especially in the case of nitroricinolein. Added in small proportion to guncotton this product makes an excellent smokeless powder, the rate of combustion of which can be regulated with great accuracy. It mixes well with nitro-glycerine, and not only prevents it from freezing in our climate, but affords a ready means of modifying its explosive action when too great a shattering effect is not desired. There are many other interesting properties possessed by these nitrated oils; but I must now pass on to the manufacture of the materials which you see before you.

The nitrated oil which has been separated by subsidence from any water that may have been mechanically mixed with it is a sherry-coloured, viscid liquid, of agreeable odour. Here are samples of nitrolinolein and nitroricinolein; you will notice that they bear considerable resemblance to each other, and I ought to remind you that they are not easily removed from the hands or clothes, as the usual solvents of oils will not dissolve them. These samples have been dried; the nitrated oil, as generally used in the factory, is turbid, owing to the presence of about 1·5 per cent. of water which cannot be removed by subsidence. The collodion cotton is used wet, and the two materials are thoroughly incorporated and then dried. One of the ingredients of the "velvril" materials being a liquid, and the other a hard solid substance, it is obvious that the hardness of the resulting compound may be modified to any extent by altering the proportions in which these ingredients are mixed. Any consistency may be obtained, from that of celluloid or vulcanite to a soft, elastic substance like the softest india-rubber. As a matter of experience it has been found that this adaptability of texture is very valuable in special cases, and a great number of mixtures are made on the large scale. For this reason it is difficult to find any single name which could be applied collectively without giving rise to misunderstanding. The word "velvril" is the trade-mark of a company and not the name of the material. Each mixture is known by a letter and number. The mixture which most closely resembles Para rubber in texture contains about two parts of nitrated oil, and one part of nitro-cellulose. The samples which are being passed round will give you an opportunity of judging of its physical properties. In thin pieces it is of an amber colour, and for special purposes it may be made nearly colourless in thin layers. The elasticity is about 25 per cent., and although the resiliency is not so great as that of india-rubber, yet the material is, nevertheless, quite elastic. So far as our experience goes the durability is much greater than that of india-rubber, gutta-percha, or any similar material. This was to be expected on theoretical grounds, the least stable molecule of the ricinolein having been replaced by the stable mineral molecule of the nitric acid. Practical tests have fulfilled this expectation, at any rate so far as a period of more than four years is concerned. Here is a slab of material made more than two years ago; it is absolutely unaltered. Here again is a piece of black compound which has been hanging on a tree for more than three years exposed to all the vicissitudes of our variable, if not very rigorous, climate. On a portion of one side only there are a few extremely minute cracks, visible only in a good light; this was the side most exposed to the sun. Gutta-percha exposed under the same conditions is quite rotten in a few months, and india-rubber of the best quality will not stand for a year.

Articles made of "velvril" materials may be placed in boiling water without losing their shape, although with the higher temperature they become somewhat more supple. By great pressure and heat combined, however, these materials can be moulded into any desired shape. There are, therefore, two methods of producing solid articles from the new material. One is that just described, the other is the moulding of a paste or solution which has been rendered plastic by the addition of a small quantity of solvent. In the former case the articles are finished and ready for use as soon as they leave the press, in the latter the solvent must be removed by evaporation, which is done by placing the articles in a room heated to about 100 Fahrenheit. These cones which are used for a special purpose on account of their resistance to the action of oil have been made under a pressure of about 10 tons per square inch, this embossed material at about 5 tons. As showing the elasticity of the material, I will pass round a piece of the same film, which has been pressed in the same mould under a pressure of 5 tons; but cold instead of hot. You will see that the pattern produced by the pressure has now nearly disappeared. Here are some impressions of delicate lace made in the same way, the finest threads are distinctly visible and can be reproduced by etectro-deposition of metal in the mould. But by far the simplest method of making a mould is to brush the object to be copied over with some "velvril" solution. On the evaporation of the solvent, the mould may be removed by immersing in water or surrounding with a damp cloth. The thickness of the mould may be regulated by the number of coats given or by the strength of the solution. Such moulds are much more elastic than those of gutta-percha and can be used in hot electrolytic baths.

From the properties of the material which have been described to you, you will no doubt have formed the conclusion that it can be adapted to a number of uses. This has already been done to such an extent that I can only refer briefly this evening to the chief applications, selecting those which have attained the largest proportions or which may possess special interest for you.

Machine Belting.—Most of you have some connection with one of those factories upon which our British trade depends. You will therefore be aware of the difficulty of obtaining really reliable machine belting. I think that most engineers of experience would prefer leather belting; but the price is high, and with modern methods of quick tanning, leather is not always as reliable as it used to be. One of the first points to which I directed my attention as soon as the "velvril" material had been developed and the new plant required for its manufacture had been designed and erected was to test its suitability for machine belting. A number of experiments were made, which have finally resulted in the production of belting such as the samples you see here. Belts like these have been running for more than two years under very trying conditions without showing appreciable signs of wear. The fabric which forms the basis is a cotton canvas of special make. This is saturated and coated with a solution of "velvril" material, and is then folded over to the required thickness and cemenited together by means of specially constructed machinery. Such belting has very great strength, is waterproof, and absolutely unaffected by oil or by any climatic change of temperature. It has been found specially suitable for hot climates where no other kind of belting has hitherto proved quite satisfactory.

"*Velvril*" *Fabric.*—The prepared canvas, from which the belting is made, can be used for a variety of other purposes. Trunks and portmanteaus can be made of it that will even resist the efforts of railway porters, and do not, like leather, become mouldy in a damp climate or situation. I have here a number of other fabrics that have been coated with various "velvril" mixtures. Here are ground sheets used for sleeping on when camping out, and which, I hope, will add to the comfort of our soldiers in South Africa. They are not only more durable, but also stronger, weight for weight, than india-rubber sheets. Here you see a roll of the "velvril" sheeting from which the ground sheets and similar articles are made. By coating one side of a fabric and cementing the coated surfaces together, a double texture material is obtained, such as you see here, and this loin-cloth for horses is made in the same way. For all these applications the power possessed by "velvril" material of resisting the greasy matter of the perspiration with which they come into contact is of great importance. "Velvril" material is not only inert towards oil, but also towards gas, and this has suggested its use as an impregnating material for the fabric of which balloons are composed. Hitherto boiled linseed oil has been used for a varnish; this is not only permeable to gas; but its oxidation products rot the fibre, and in about a couple of years the balloon becomes unsafe. The weight of the balloon fabric is increased by about 63 per cent. when varnished with boiled oil, and increase of weight is precisely what the balloonist objects to most strongly. Provided he has a mass of gas as big as a house the less fittings he has round it the better he likes it. Now this balloon material has been treated with a "Velvril" compound until it is impervious to gas or water. Owing to the natural tensile strength of the "velvril" film thus formed the strength of the prepared fabric has increased considerably while the increase in weight is only 29 per cent. or less than half that of the linseed oil dressing. This thin fabric may be used for a variety of purposes, especially for surgical dressings; but a still better material for that purpose is "*Velvril*" *Film.* Of this I have brought two kinds, the thinner one is of a slightly softer composition than the thicker one. As you will see, it is a clear, yellow, elastic membrane, the edges of which can be easily united by means of a solution of "velvril" material. The chief use of this thick film at present is in connection with printing machinery. It does not absorb printing ink, which has no action upon it. I may mention that "velvril" material has been successfully used not only for printing-ink rollers, but for type as well. The latter can be made of any desired degree of hardness, and when worn out the material can be used again. For insulating and waterproofing electric wires, strips like these are used. The facility with which it can be cemented together renders the material specially suitable for this purpose, and also for making joints between electric wires. Films may be made of any colour, and the surface can be decorated in a variety of ways. Those which are being passed round are intended for book-binding purposes.

Insulating Wire.—Wire may be coated with "velvril" compounds in various ways. The method I have mentioned of wrapping strips of film spirally round a wire, cementing them at the same time, is a simple one; but the insulation is not so perfect as when the material is applied in a continuous mass without joints. This may be effected in two ways. One is to apply successive coatings of a stiff paste containing solvent, drying off the solvent before the next coat is applied. This is necessarily slow, involving as it does an interval of several hours between the coats. The other method is to use "velvril" material without solvent, and to render it plastic by heat and pressure combined. In this way a homogeneous coating may be obtained in one operation such as you see on this piece of insulated wire. The pressure required is considerable, in this case about 15 tons per square inch was used, and the material was previously strained at a pressure of more than 50 tons per square inch. Of course special machinery has had to be devised for these operations, some of the details of which are still being worked out. The "velvril" paste being a strong cement it is obvious that other solid insulating substances may be incorporated with it. The inert, stable nature of the compound precludes any action upon the wire; in fact a "velvril" coating may be applied to the wire first to protect it from other insulating materials which have a deleterious action upon the metal.

Hose and Tubing.—From what you have already heard about the properties of this material, you will understand that it is specially suitable for hose or tubing for the conveyance of oil or gas. Gas tubing like that shown has been in use for more than two years without any perceptible deterioration. In the laboratory such tubing can be used for a variety of purposes from which india-rubber tubing is excluded. For instance, it can be used for making the connections in extraction apparatus in which benzine or carbon disulphide is the solvent used. For vacuum tubes it has special advantages, as it can be made of any required degree of hardness. The hose of which you see several kinds on the table is made in the same way as india-rubber hose, but does not require vulcanising. For such purposes as garden hose its resistance to atmospheric influences is an advantage. This pressure hose is made for conveying compressed oil gas; it contains a spiral wire embedded in the mass.

Textile Industries.—There are numerous applications of "velvril" materials to textile industries, but I shall only mention those which have been thoroughly tested on the large scale, and are being rapidly adopted. The most important operation to which textile fibres are subjected previous to spinning is carding. The carding wire with which this is done is familiar to most of you. It consists of a thick fabric carrying a large number of steel points which catch the single fibres and arrange them longitudinally. This fabric is known as carding-wire foundation, and must possess a considerable amount of elasticity, in order to give free play to the steel wires. In some cases india-rubber has been used for foundation, in others, leather. With wool, especially, which contains much grease, leather has been the chief material used. A compound fabric coated and cemented together with "velvril" material has now been in use some time, and has given very satisfactory results. You will see from these samples of carding-wire that while the wires are mobile they are yet held tightly in their places by the "velvril" material.

In the spinning process this new substance has also found an important application. During the process, each thread passes between small friction rollers which were formerly, and are still chiefly, made of felt covered with thin leather. A certain amount of elasticity is required, but india-rubber is out of the question on account of the oil and grease of the machinery. Rollers have been made with a surface of "velvril" film, and these appear to be much more durable than any other material available.

Tapestry carpets are now made of yarn which is dyed upon collapsible drums covered with a waterproof material. After dyeing, the covering of the drum is removed with the dyed yarn and the whole washed, steamed, and subsequently dried. Cloths of cotton saturated with linseed oil varnish were used for this process, but had a very short life. Trials were made with the cloth shown here, and it has been found that it resists the somewhat trying ordeal to which it is subjected at least five times as long as the fabric which preceded it.

Cement.—From the numerous samples you have seen, especially the compound fabrics, you will have gathered that "velvril" material is a powerful cement. This paste is used for cementing a variety of substances, such as wood, metal, leather, glass, &c. The joint which it makes is waterproof, and, being also slightly elastic, it yields sufficiently to allow for the expansion and contraction of metals, or the shrinking of wood, without breaking the joint. One use to which this cement has been put in connection with railways may interest you. The nuts upon the bolts that fasten the fishplates are very liable to shake loose on account of the excessive vibration to which they are subjected. A small quantity of paste placed on the thread of the screw before the nut is screwed up effectually prevents the nut from shaking loose. The cement is also the basis of a number of compositions, the germs of future industries. Here is a sample of floorcloth made with a cork mixture. This can be made much tougher than linoleum and will probably retain its elasticity much longer. Here are elastic stoppers for bottles which have advantages over india-rubber, besides their lower cost. The pores in ordinary bottle corks may be effectually closed by injecting a liquid solution under pressure. Bottles already corked may be sealed either by dipping into a solution or by pouring a small quantity upon the cork. A piece of film placed inside the cap of a screw-cap jar or bottle gives an air-tight joint, which is not always the case with cork. For bottle-rings the "velvril" material can either be moulded under pressure direct, or cords like these can be cut into lengths and cemented together, as shown.

Varnish.—In the form of a solution, there are a great number of uses for "velvril" material. Almost any material may be varnished or impregnated with it. A special industry has been started, having for its basis felt impregnated with a "velvril" varnish. Another use which is attaining considerable proportions is the waterproofing or coating of cords, lines, &c. For fishing lines, especially, this material has met with much approval. Here are two lines, one new, a salmon line, the other a trout line, which has been used during the last season, but shows little indication of wear. Thread that has been impregnated in this way can be woven and knitted, or used for sewing. If a seam made with it be moistened with "velvril" solvent the thread is cemented into the holes through which it passes and the strength of the seam is considerably increased. Paper of all kinds can be coated and rendered waterproof and greaseproof. For sporting cartridges such a coating has the advantage of being elastic and supple, so that it does not crack when the case is turned over. A tough combination of fibre and "velvril" material, such as the sample shown, is made for washers, &c.

Safety Fuse.—In order to communicate the fire to a blasting charge in a wet bore-hole or under water the safety fuse containing the thread of powder used for that purpose must be coated with a waterproof material. Gutta-percha has been largely used as a coating, but has the disadvantage of rapidly oxidising and becoming brittle and porous, and also of softening in a hot climate or even in the temperature prevailing in some mines. A "velvril" coating such as has been applied to these coils of fuse is free from these defects, and a careful series of tests has shown that the coating is perfectly waterproof.

Paint.—All the oil-paints now in use suffer from one serious and innate defect. The elastic substance formed by the oxidation of linseed oil when exposed to the air is not the final product, but only an intermediate stage. The final, or at any rate the next, stage results in the formation of an acid syrup which has but little power of cementing the particles of pigment together and which corrodes ironwork instead of protecting it. I have explained this reaction more fully on previous occasions and only refer to it here to show the importance of a neutral medium that may be assumed to be reasonably permanent. The varnish just referred to dries through the evaporation of the solvent and, so far as an experience of about four years shows, there is no perceptible oxidation. All that is required, therefore, to obtain a good paint that may reasonably be assumed to be durable is to mix a suitable pigment with the varnish. Surfaces coated with such paints have been exposed to very trying atmospheres which they have successfully resisted. The pieces of wood shown are painted with these paints in various tints. It seems a pity that so many of our artists should be painting their pictures on and with such perishable materials. There has been a great change from the practice of the old masters and that change is decidedly in the wrong direction. The prepared canvas, especially, which is now in general use is anything but durable and the premature decay of many pictures can be traced to it. The best preserved oil-paintings are those painted on wood panels with a very thin film of paint, the thinner the backing the better for the paint upon it. The picture you see here has no doubt attracted your attention from the moment you entered the room. Its chief interest, of course, lies in the fact that it is a beautiful work of art by Miss Helena Fisher whose pictures are so well known in another part of this building. But it may further interest you to know that the canvas upon which it is painted has been coated with "velvril" material and the future owner of it may reasonably hope that it will be a little more durable than most modern oil-paintings.

Enamelled Leather.—The question of a durable surface brings us to another application of the new material of some importance, namely, as a coating or enamel for enamelled or patent leather. Ordinary patent leather is made with a linseed oil varnish of which several coats are applied and the finishing surface is obtained by means of a harder copal or other varnish. Between the various coats the leather is stoved and rubbed down until the surface is smooth. A number of experiments have been made with different "velvril" compositions with the object of producing a surface devoid of the serious tendency to crack which is so obvious in the case of the ordinary article. You see on the table various samples of such enamelled leather together with shoes made of it. Some of the samples are more than two years old and show no tendency whatever to crack.

Time will not permit me to describe other applications of "velvril" material or even to refer to all the samples shown.

Each day brings new uses and probably many of you in this room will have thought of others.

In conclusion I wish to express my obligation to Mr. Vavasour Earle for many valuable suggestions during my experiments and their subsequent industrial development, and to Mr. J. Howkins for his assistance in surmounting the mechanical difficulties which must necessarily arise during the creation of a new industry.

We are indebted to the following firms for the articles mentioned in connection with their names:—The Velvril Company, Limited, at whose factory at Lonesome, Streatham Common, the whole of the "velvril" material shown was made.

The Gandy Belt Manufacturing Company, Limited, for the exhibit of machine belting, Messrs. P. B. Cow & Co. for hose, tubing, and other articles.

Discussion.

Prof. F. Clowes said that those who were conversant with Nobel's mixture of nitro-compounds, commonly called blasting gelatin, knew that in preparing this substance, the guncotton was actually dissolved by the nitro-glycerin. It had always seemed to him remarkable that one nitro-compound could thus dissolve another. But it now appeared that a similar action took place in the manufacture of velvril material, or that at least the two nitro-compound constituents remained permanently associated after they had been blended by a suitable solvent. Mr. Reid had stated that the material was combustible but non-explosive, and had shown that its combustibility was no more serious than that of india-rubber or gutta-percha. He had also made experiments upon its explosibility, and had stated that no danger would arise from this cause in the actual use of the material. It would be of interest to learn that Mr. Reid had tested the liability to explosion from all possible causes. Guncotton, which was similar to the nitro-cellulose present in the new material, could not in itself be exploded by being kindled, and also refused to explode when subjected to the percussive action of many substances detonated in contact with it. Certain special detonators, however, developed powerful explosion in contact with guncotton. It would be well to know that the nitro-compounds of velvril were incapable of developing explosive force in contact with any kind of detonation to which they could be subjected. This could only be proved by a lengthy series of varied experiments. Probably Mr. Reid could satisfy them on this question.

Mr. H. de Mosenthal remarked that Mr. Alfred Nobel did not abandon his work on rubber substitutes because of their explosibility, but because he had up to near the time of his death failed to find a substitute which had the resilient properties of india-rubber. Another very interesting part of the problem, and one upon which he might himself have something to say before them later on, was the physical condition of the nitro-cellulose in such combinations. What happened when it lost its fibrous structure and was resolved by the action of solvents into an homogeneous mass? The viscose of Cross and Bevan was outside this line, because it was a new chemical compound, and not a disintegration of the fibrous cellulose.

Mr. J. B. C. Kershaw said that as Mr. Reid had referred to the material as an insulating compound he would like to ask how it compared with rubber in that respect, and what voltage it would stand before the insulation broke down.

Dr. S. Rideal said that with regard to the explosiveness and non-acid character of this material, he would point out that, as it consisted of a mixture of nitrocellulose and nitro-ricinolein in different proportions, when small quantities of the latter were present it would be more prone to be explosive; but when a large percentage was mixed with the nitrocellulose it tamed it down, so that, as they had seen, it burned like ordinary rubber. The harder forms of the material having less of the "tamer" would perhaps be liable to explosion. He would like to ask Mr. Reid whether the explosive character of nitrocellulose existed in any of the article which he was putting on the market. Mr. Reid had referred to the non-acid character of the material when used as a vehicle for pigments; but although the nitric acid was well washed out in the course of manufacture, he could not but think that the introduction of a nitro group into the molecule must confer acid characteristics upon it.

Mr. H. D. Richmond wished to know whether the material in the form of a flexible tube was capable of withstanding the action of steam or hot water; also what class of india-rubber it was expected to supplant.

Mr. J. Cardwell Quinn thought that Mr. de Mosenthal had hit the right nail on the head when he referred to the resilient properties of india-rubber. Among all the products which he had inspected that evening he had not seen a single sample which would compare favourably with india-rubber in those respects. The success of the material would depend entirely on its cost. Some forms of it would be useful if it could be produced cheaply enough. Some years ago he had worked on rubber substitutes himself, not using a nitrated castor oil product, but castor oil *plus* a collodion cotton product. Using that he found it possible to add even 90 per cent. of guncotton; yet he could not produce it cheaply enough to compete with india-rubber. The hose exhibited by Mr. Reid would not compare with india-rubber hose at all. Its nearest analogue was gutta-percha, and of that body he did not know sufficient to be warranted in expressing an opinion. Referring to a previous speaker's question as to the insulating properties of the material, he might remark that those properties depended chiefly on the electric conductivity of the material, and he would be pleased to hear something more on that point; in fact, next to the question of cost that was perhaps the most important matter, for the actual strength of the materials before them did not compare with even cheap india-rubber.

Mr. Clayton Beadle wished to know whether Mr. Reid had made any tests of the insulating qualities of his product. Some insulating bodies were very good in ordinary dry atmospheres, but broke down in a moist one. Tests made in a dry atmosphere might therefore be misleading.

Dr. J. N. Goldsmith enquired what was the percentage of nitrate in the nitrocellulose employed.

Mr. Vavasour Earle stated that, although it had been his privilege to be associated with the author during his experiments on this new material, yet there was much in the paper which was quite new to him. He himself regarded the matter from a purely practical standpoint, and looked at from that point of view, the material was appreciated chiefly on account of its power of resisting the action of oils. Naturally cost had a great deal to do with the success or failure of a new material, and he was therefore glad to be able to assure members that he had no anxiety for it on that account.

Dr. J. Lewkowitsch congratulated Mr. Reid on having opened out a new field of technical application of oils by his reaction, as he considered that they had not as yet more than scratched the surface as regards the future use of fats and oils. He did not know whether Mr. Reid would or could reply as to the nature of the reaction that went on in the production of velvril compounds. He fancied that it was less nitration than oxidation that occurred, and that nitro-cellulose was more or less the backing of the material, while linseed oil or castor oil gave to the compound its quality of flexibility. Referring to the glycerin question, he was not sure whether he rightly understood Mr. Reid to say that glycerin had nothing to do with it.

Mr. Reid, interposing, said there was no nitroglycerin in the finished product, but there was undoubtedly glycerin in the raw material.

Dr. Lewkowitsch, continuing, said he had asked this question because it might be inferred that the free fatty acids might yield the compound, whereas from other products of a similar nature he concluded that the glycerides only were useful, the free fatty acids leading to useless products.

The Chairman wished to express his congratulations to Mr. Reid on having been so successful in producing a substitute for india-rubber and gutta-percha. It was evidently a substance full of the promise of a great future. He would like to know more about the chemistry of the interesting nitro-oil, which Mr. Reid had discovered. The percentage of nitrogen corresponded very nearly to that of a mono-nitro-ricinolein. He suggested that possibly Japanese wood-oil might be even more suitable for the author's purpose than castor or linseed oils, seeing that it formed elastic compounds readily.

Dr. Newton asked for further information as to the use of the author's new material on fish-plates used in connection with railway metals. He would like to know how long the material had been so used, and whether there had been any explosions.

Mr. A. R. Ling enquired whether the material had been tested with regard to its resistance towards acids and caustic alkalis.

Mr. W. F. Reid, in reply, said that as several gentlemen had asked practically the same questions about the nitro-cellulose, he would reply to them together, beginning with Dr. Clowes and Dr. Rideal. These gentlemen appeared to think that the material might be explosive, because it contained a certain amount of nitro-cellulose. But he would remind them that not all forms of nitro-cellulose were explosive. The nitro-cellulose employed in this material was of the lowest degree of nitration, containing less than 11 per cent. of nitrogen, and in this form it was not an explosive, it could not be exploded. He was tolerably well acquainted with the explosives industry, and had thoroughly tested this material in that respect; and under no conditions—even with so little as 5 per cent. of castor oil,—could it be made to explode. It had been tested by the Home Office, and was not considered an explosive by them. If any member still had any doubt on the subject he would be happy to supply him with samples for testing. Dr. Clowes and Mr. de Mosenthal had referred to the state in which the nitro-cellulose was present in the material. The nitrated oil was to a small extent a solvent of the particular nitro-cellulose used. He had shown that evening a mass of the material which had been mechanically mixed with the nitrated oil, and though it appeared to some extent translucent, yet by using a magnifying glass the fibres could be plainly seen. The film, on the other hand, was perfectly clear, but experience would not warrant him in saying there was absolutely no undissolved fibre in it. To the eye, the fibre was apparently completely destroyed, but under polarised light it might be possible to find some. With regard to the insulating power of the material, and the voltage at which it might break down, he had stated in the paper that several ways of applying the insulating substance had been tried. The method he preferred was to coat the wire with the pure material at very high pressure, and with the apparatus now being made, he hoped to obtain even better results than those shown, but as this matter had not yet reached finality, he thought it would be better not to give the figures at present. He had notes on the subject which he would be happy to show to anybody interested in it. The material was a good insulator, but he did not claim that it was a better insulator than the best gutta-percha. With regard to the action of high pressure steam on these substances, he was afraid that they were no better able to resist that action than all other organic materials. Mr. Quinn had said that there was no resemblance between this substance and india-rubber, and he was very glad to hear it, for india-rubber as it was now put on the market was very unsatisfactory. There was a great deal of elasticity in india-rubber itself, but he was afraid there was still more in the name, as some of the substances which appeared as india-rubber contained the merest traces of that useful material. He would have been only too glad to have given Dr. Lewkowitsch some of the figures from his note-books in connection with his experiments on the reactions taking place during nitration, but unfortunately it was not possible in the time at his disposal. His own view of the action which took place was that the first stage consisted of the splitting up of the glyceride; then the glycerin was decomposed; but what followed next, he was not quite sure of. The down grade on the curve, shown on the board, was somewhat of a mystery to him; the up grade was mainly the nitration of the linolein or ricinolein, not even traces of nitroglycerin could be detected in the oil after nitration. He preferred to call the substance which formed the nitro-compound by the name in the text-books, because knowledge on the subject of the chemistry of castor oil and linseed oil was in a most primitive state, and the more one went into the subject the less one seemed to know. With regard to the Chairman's suggestion that wood-oil or tung-oil should be used, that oil had marvellous drying capacity; but it was rather difficult to nitrate, and when nitrated it yielded a dark-coloured pasty mass which was not easy to purify. They nitrated about three or four hundredweight of oil at a time, and very careful mixing and washing were required before it became absolutely pure. The product contained at least 5 per cent. of nitrogen combined chemically with it, and it was not an oxidation product. The oxidation products were free from nitrogen and of lower specific gravity.

Mr. Quinn, interposing, said he should like to have some information as to the cost of "velvril" material compared with india-rubber. He would remind Mr. Reid that india-rubber, such as could be cut up into small strips capable of being pulled out to eight times their normal length, would cost about 5*s.* per pound. That would be the best Para rubber, and it could be made into all sorts of articles selling for as little as twopence halfpenny per pound.

Mr. Reid replied that comparison with such articles as that would hardly be useful, as the price showed how small a proportion of rubber they contained, especially as even the low price of twopence halfpenny must contain a little profit as well as rubber.

Manchester Section.

Meeting held on Friday, November 3rd, 1899.

VICE-CHAIRMAN'S ADDRESS.

ON THE LIMITS OF ACCURACY IN TECHNICAL ANALYSIS.

BY DR. J. GROSSMANN.

In carrying out an observation or experiment it is not sufficient that we should do our work as carefully as possible, it is even more important that we should enquire what errors we may be liable to commit, and thus be able to prevent, remedy, or correct these errors. This truth has long been recognised in physics and astronomy; it has been applied to chemistry in theoretical investigations, notably in the determination of atomic weights; but it has not, in my opinion, received the attention in technical analysis which is due to it; it has not, to my knowledge, been clearly discussed in any technical text book, and for this reason I may be allowed to draw your attention to this important subject, and try to explain the principles which underlie it.

In an admirable essay on "The Equalisation of Errors of Observation," incorporated in his supplement to Physics, Professor J. Müller introduces the reader into the general mathematical principles of the subject, and illustrates his meaning by examples taken from physics and chemistry, and as it would be impossible to improve on his definitions, I have adopted them in the following general introduction, and have also quoted a few of the examples which he has taken from physics.

To start with then, it must be clearly understood that no observation or measurement, however carefully performed, can be accurate. For we use instruments which in themselves are not perfect, and we have to use our eyes or our ears to convey our impressions to our minds, and these senses are only limited in their perceptions. We may try to sharpen the susceptibility of our senses; we may, for instance, add to the power of the eye by using a microscope or a telescope; but in doing so, we only remove the limits of susceptibility further. The results, even then, are not absolutely accurate, and though the errors of observation may thus be diminished, they are not effaced; again, even here, absolute accuracy cannot be attained.

It is evident that the errors which affect our work may be of a constant or accidental nature. If constant, it will be comparatively easy to discover the law by which they are governed; if accidental, they will require special consideration in each case.

To give a few examples of constant errors, we may take the effect of temperature on measuring instruments; or the displacement of the zero point in thermometers, or the degree of sensitiveness of an indicator in volumetric analysis, which will influence the accuracy of the results, and which, although differing with different indicators, will, under the same conditions, be a constant for each.

The incidental errors, on the other hand, are those which cannot be reduced to a law; they vary with each experiment, and may sometimes cause the result to be too high and sometimes too low. They are mostly due to the imperfection of our senses, or to the imperfection of the instruments we are using. Thus, if we wish to determine the number of vibrations belonging to a certain sound, for instance, that of a tuning fork, we have to tune the siren exactly to the fork. We cannot, however, do this with perfect correctness, as our ear cannot distinguish differences in intervals beyond a certain limit which varies with individuals. The siren will give sometimes the number of vibrations higher, and sometimes lower than the absolute number. Another instance we have to deal with in our daily work, is reading off decimals of cubic centimeters on our burettes; this can only be done approximately, and the errors we commit will sometimes give the result too high, and sometimes too low. In like manner in matching colours, it is impossible to get the shade to absolute exactness, and the errors here will vary within certain limits which will differ with different operators.

In chemical work, both constant and incidental errors are often due to bye-reactions which may not be known at the time. Thus even Liebig on analysing a number of organic silver compounds, overlooked the fact as pointed out later on by Marignac, that on igniting the organic salts, a small quantity of silver became volatilized; the consequence being that he found the weights for silver too low. It is, in theoretical as well as in technical work, generally assumed that the safest way to correct errors is by making a number of analyses and taking the arithmetical means of all determinations as the one nearest the truth. But it is evident that if the method itself be afflicted with an error which we do not know, then all the tests as well as their average will be incorrect to the extent of that unknown quantity which need not of necessity be a constant, but may vary with each experiment. Such an error will become even more serious, if the determination of two or more substances is made at the same time, and if the amount of each substance depends upon the correctness of the amount of the other substances. Thus taking the instance referred to above, if we attempt to calculate the atomic weight of carbon as well as that of silver from Liebig's analyses as Strecker did many years ago, we find the atomic weight of carbon far too high. Wherever a method is faulty in itself, the average of a number of estimations must be incorrect, whether this average be calculated by elementary mathematics or by all the refinements of the calculus of probability as applied to the method of the least squares.

The example given above is only one of many of which it could be shown that even our greatest chemists have overlooked certain constant or incidental errors in analysis, and that, in such determinations as were intended to settle the question of the atomic weight due to elements. With the exception of a few instances in which we weigh the substance to be determined direct, we depend for the accuracy of our analyses in the first place on the accuracy of our atomic weights; and the first question, therefore, which we have to settle in determining the limits of accuracy in technical analysis, is that of determining the accuracy of our atomic weights. It is necessary in discussing this question to refer to a standard authority, and I am, therefore, basing my remarks on this point on that excellent compilation by Lothar Meyer and Seubert entitled "Die Atomgewichte der Elemente."

Even those who have not given much study to the actual means and methods which have been used for the determination of our atomic weights, are aware that these determinations have been made with the most accurate instruments, and that all the resources of mathematics have been used to calculate the results correctly. But in his compilation Lothar Meyer has thrown these complicated calculations overboard. Taking the method of the least squares which has been used for calculating the most probable value of errors of observation, he states that the actual errors of an atomic weight determination are almost without exception greater than those calculated by means of that method. Again, in speaking of the reduction of apparent to actual weight, Lothar Meyer shows that it is of no value except in cases where the atomic weight estimations are of such accuracy, that the errors are within about one-tenth per cent. of their absolute value. Discussing this subject Lothar Meyer says: "As long as the atomic weights were only used for calculating analyses, it might have been sufficient, if their errors were not so large as to interfere with the accuracy which was demanded of the analysis. Now, however, we must consider it as the aim of our science to determine these fundamental constants with the utmost accuracy, so as to be able to determine exactly by number and measure the influence which they exert on the properties of matter. But, from this goal unfortunately, as regards most of the elements, we are, as yet, far removed. Apart from the rare elements whose existence is still dubious we know a considerable number for which the several atomic weight determinations differ by one or more per cent. of their values, without it being possible to determine which of these values should have preference. Although this fact may be generally known, it will perhaps surprise many chemists to notice the great discrepancies in the values found; especially as these discrepancies do not only appear in the determinations of different scientists, but in the values found by the same experimenter."

This is a severe indictment, which, unfortunately, except as regards the first sentence is incontroversible. To that sentence I cannot assent, and I think the author must have intended to give it a different meaning to that which we should attribute to it; for in another place he contradicts it himself. In discussing those atomic weights which have been acknowledged to be accurate, he gives it as his opinion "that it is time to give up the bad habit of using incorrect figures, such as O 16, C 12, Ag 108, Cl 35·5, Br 80, &c., which are still used out of sheer habit although they are wrong by $\frac{1}{3}$ per cent. of their values. With these incorrect figures the Cl in NaCl comes, *e.g.*, to 60·684 per cent., whereas, in reality, it is only 60·596 per cent. These approximate atomic weights may be admissible in rough tests, but it is absurd to use, for the control of an analysis, numbers which are subject to errors as great as those inherent to a careful analysis."

Lothar Meyer has altogether critically examined about 620 odd different determinations of atomic weights, and from these calculated the most probable value for each element. When we consider that each determination is the outcome of years of hard and patient work, the reflection of what thought and labour a table of atomic weights really represents is truly appalling. The study of these determinations in detail is most instructive, as it reveals surprising discrepancies amongst great experimenters. Thus not including the classical determinations by Stas, we find that for silver, Berzelius, Turner, Marignac, Millon, Maumené, and Dumas, found between 106·46 and 108·02, a difference of nearly $1\frac{1}{2}$ per cent. between the lowest and highest; for barium, great chemists differ from 135·1 to 138·14, *i.e.*. nearly $2\frac{1}{4}$ per cent., and this leaving out an isolated determination by Marignac which gives 130·37, and would therefore be about 6 per cent. out. I have calculated the discrepancies through and they are as follows:—

No. of Determinations.	——	Minimum.	Maximum.	Discrepancy between Maximum and Minimum in per Cent. on Minimum.
10	Aluminium	26·986	27·47	1·79
15	Antimony	119·32	128·7	7·86
7	Arsenic	74·05	75·25	1·62
15	Baryum	130·37	138·14	5·85
6	Beryllium	9·081	9·77	7·58
13	Lead	206·29	209·38	1·46
7	Boron	10·37	11·04	6·45
4	Bromine	79·745	79·775	0·04
4	Cæsium	123·01	132·70	7·39
9	Calcium	39·88	40·37	1·26
13	Cerium	137·1	142·0	3·57
15	Chlorine	35·203	35·396	0·55
16	Chromium	51·60	55·89	8·32
1	Decipium	9·962	..	..
11	Didymium	141·2	147·01	4·12
8	Iron	54·10	56·18	3·84
3	Erbium*	166·0	170·55	2·74
11	Fluorine	18·82	19·15	1·76
2	Gallium	69·52	69·91	0·56
3	Gold†	195·86	196·74	0·45
6	Indium	107·49	113·56	5·65
5	Iridium	192·54	197·5	2·58
5	Iodine	125·33	126·697	1·09
6	Cadmium	111·2	112·03	0·74
17	Potassium	38·832	39·19	0·93
12	Cobalt	58·59	59·87	2·19
8	Carbon	11·92	11·98	0·50
7	Copper	62·96	63·30	0·54
19	Lanthanum	132·5	140·92	6·35
14	Lithium‡	6·049	7·18	18·8
12	Magnesium	22·89	25·2	10·05
11	Manganese	53·89	56·51	4·84
22	Molybdenum	88·8	101·6	14·45
1	Mosandrium	139·5	..	..
4	Sodium	22·92	23·11	0·83
9	Nickel	57·9	58·91	1·74
6	Niobium	93·50	96·67	3·39
1	Norwegium	145·95	..	..
4	Osmium	195·0	199·2	2·16
1	Palladium	106·2	..	..
5	Phosphorus	30·96	31·95	3·19
9	Platinum	194·18	197·9	1·92
9	Mercury§	199·18	200·65	0·74
2	Rhodium	104·06	104·08	0·02
3	Rubidium	85·18	85·25	0·08
2	Ruthenium	102·8	103·56	0·59
4	Oxygen	15·96	16·00	0·25
1	Samarium	115·6	..	..
1	Scandium	43·97	..	..
4	Sulphur	31·87	32·53	2·08
13	Selenium	77·59	84·6	9·01
10	Silver	106·46	108·02	1·46
5	Silicium	26·94	29·5	9·52
4	Nitrogen	13·976	14·028	0·36
11	Strontium	86·95	88·00	1·21
5	Tantalium	165·8	183·75	10·85
6	Tellurium	126·7	128·45	1·38
1	Terbium	113·0	..	..
7	Thallium	202·83	204·45	0·79
27	Thorium	222·9	245·4	9·95
1	Thulium	171·0	..	..
4	Titanium	48·13	61·3	27·4
11	Uranium	233·5	251·1	7·54
12	Vanadium	49·3	61·74	25·2
4	Hydrogen (O=1)	0·0625	0·06265	0·24
5	Bismuth	207·5	214·6	3·42
21	Tungsten	173·9	190·40	9·48
3	Ytterbium	172·5	177·0	2·61
9	Yttrium	89·55	102·3	14·55
6	Zinc	64·36	65·85	2·32
7	Tin	115·83	118·16	2·02
7	Zirconium	88·56	90·76	2·48

* Leaving out two determinations of M. Delafontaine, 118·7 and 118·8.

† Leaving out one determination of J. Juval, 201·0.

‡ Leaving out one determination by Arfredson, 10·10.

§ Leaving out one determination by Sefström, 202·03.

Truly, in the face of these discrepancies, it is not an easy task to decide which figure is nearest to the truth. Should one be guided by the greater or lesser confidence which the name of the experimenter inspires? Or should one be convinced if the results of the same investigator agreed amongst themselves, and which might after all be only due to a constant error? There appears to be only one certain criterion, and that is, if the values found by totally different methods agree. Of such numbers we have only very few amongst our atomic weights. As it is of the greatest importance that we should know which degree of accuracy is due to the respective atomic weights, Lothar Meyer has classified them in four classes, giving the degree of accuracy in decimals of hydrogen, or more simply in decimals of the unit. For practical purposes, however, this classification is, in my opinion, not as useful as one which shows the error in parts per 100 or per cent., as naturally, *e.g.*, 0·1 on a low atomic weight would bear a very different construction to 0·1 on a high figure. Thus 0·1 on Li = 7 would be $1\frac{1}{2}$ per cent., on barium it would only be 0·07 per cent. I have, therefore, calculated the errors on the same basis as assumed by Lothar Meyer, but expressed in per cent., and we find then the following as the maximum errors (taking those atomic weights which Lothar Meyer gives as possibly varying between 0·5 H and H at 0·75 H.

TABLE I.

	Per Cent.		Per Cent.		Per Cent.
I	0·02	Pt	0·26	Ru	0·72
Ag	0·05	N	0·36	Rh	0·72
Pt	0·05	O	0·31	Pd	0·70
Br	0·06	P	0·32	Ga	0·72
Pb	0·05	Cs	0·38	B	0·92
Rb	0·12	Ba	0·37	Sc	1·14
K	0·13	Au	0·39	Zn	1·16
Cl	0·14	C	0·42	Co	1·28
S	0·16	Cd	0·45	Ni	1·28
Fe	0·18	In	0·44	Mn	1·36
V	0·20	F	0·53	Cr	1·45
Na	0·22	Sr	0·57	Li	1·43
Ca	0·25	Mo	0·52	Al	1·85
Hg	0·25	As	0·67	Si	2·43
Ir	0·26	Se	0·63	Mg	3·91
W	0·27	Cu	0·73	Be	5·50

Besides these there are a number of elements whose atomic weights are quite uncertain, and may be wrong by several units, in some cases even as much as twenty units. I have calculated these on the basis that they may be wrong by two units or more, perhaps considerably more: **the results in the following table, therefore, represent the minimum error in per cent.**

	Per Cent.		Per Cent.		Per Cent.
Ce	1·38	Il	0·98	Nb	2·13
La	1·44	Ti	3·98	Ta	1·10
Di	1·38	Zr	2·22	Bi	0·91
T	2·24	Th	0·86	U	0·83
H	1·16	Sn	1·70	Os	1·05
E	1·21	Sb	1·67		

These figures speak for themselves, such important metals as Tin and Antimony may be wrong by 2 per cent. or more; magnesium, $2\frac{1}{4}$ to $4\frac{1}{2}$ per cent.; zinc, $\frac{3}{4}$ to $1\frac{1}{4}$ per cent.

I have so far refrained from giving any opinion as to what degree of accuracy may be attained in technical analysis; but I trust I have succeeded in showing that a serious source of inaccuracy may be found in the atomic weights. Before discussing other sources of error we may now enquire what degree of accuracy is required in technical analysis. No hard and fast rule can be given for this, but I think we may take it that a technical analysis should be as accurate as the use for which it is required may warrant. As time is an important factor in technical work, and as very accurate work requires, naturally, more time, it is most important to be clear on the degree of accuracy which will satisfy the requirements of each case. Where it is only necessary to check intermediate operations in a factory it would often be a waste of time to go to a high degree of accuracy. In determining, for instance, the sulphur in burnt ore for each days or each burnerman's work a very rough method is found sufficient; the same in determining the sulphur in vat liquors, and hundreds of cases which occur in the daily routine of chemical works. But even in very accurate work it is not always necessary to go to the highest degree of accuracy. Suppose a substance, otherwise pure, contained an impurity to the extent of only 1 per cent., the method for determining that impurity might be 1 or 2 per cent. wrong without materially affecting the results, as the error would only show in the second decimal of a per cent.

Quite different is the case when the technical analysis has to determine the value of an article, as between buyer and seller. The enormous values in money which depend on technical analysis may be gauged by the fact that the yearly production of nitrate of soda amounts to about 3,000,000*l*., that of chloride of potassium to about 1,000,000*l*., and that of indigo to about 3,000,000*l*. In three articles of commerce we have, thus alone, 7,000,000*l*. sterling per annum, one-half per cent. on which represents 35,000*l*. But this is only a small fraction of the amounts which change hands on the result of technical analysis, as there is hardly a substance in chemistry or metallurgy which is not valued now by its test. Hundreds of millions depend upon the verdict of the chemist, and as each per cent. of an error would amount to 10,000*l*. per million, the responsibility thus thrown on chemists is very great and the results of their analyses cannot be too accurate; and it is here particularly where it will be necessary to criticize the methods used and examine their weak points carefully.

It is, however, not only necessary to do this, but also to be careful not to fall into the opposite error, and go to unnecessary trouble. Thus many chemists at one time or other of their lives have gone to the trouble of calculating their weights to vacuum. I have shown above on Lothar Meyer's authority that this is quite unnecessary as long as most of our atomic weights and our methods of analysis are as imperfect as they are at present. Moreover, in weighing substances, many chemists are most particular about one-tenth of a milligram; but even if the weights and balance were correct to that extent, which is not often the case, the error in practically all our work is greater than one-hundredth of a per cent. which one-tenth milligram in most cases represents. For this reason also it is really fallacious to calculate any analysis to the second decimal; it is only a habit which has become customary; but there is no justification whatever in calculating it to more than two decimals, unless it be to give outsiders the impression that one can work more accurately than another chemist who gives his results only to two decimals; the result itself could in most cases not be guaranteed to more than one decimal; the rest is a calculation which is of no value. There is another point which must not be overlooked, and that is the fact that a number of tests may agree well and yet represent a wrong result. For where the method used is subject to a constant error this error will affect all tests in the same direction.

As the balance and weights are the most important instruments which we use, it is necessary to enquire carefully how far these may limit the accuracy of our work; as I have stated above, it may be taken for granted that the fourth decimal of a gram is uncertain. Even if we adjust our weights ourselves, or, which comes to the same thing, make out a table of correction for them, the different combinations amongst them would bring their error to more than one-tenth of a milligram; for supposing we were to use five pieces of weights for weighing, each of them would have to be accurate to within one-fiftieth of a milligram if they were all too heavy or too light, in order to be accurate to one-tenth milligram. But one-tenth milligram is such a minute quantity that the variations in temperature, pressure, and moisture would affect it from day to day, if not from hour to hour. Then the weights would have to be adjusted periodically, and who is there amongst us that could say that he could guarantee his weights to total up to one-tenth of a milligram in all combinations? If we work with one gram of substance the error in weighing alone will therefore come to more than one-hundredth per cent. with the most accurate instruments; in most cases, as I remarked before, the second decimal of percentage will be quite illusory.

If we have to acknowledge that our balances and weights are not absolutely reliable, we are in a far worse plight as regards the instruments we use for volumetric analysis. Apart from areometers which are notoriously unreliable, we use in this class of work litre flasks, their subdivisions, pipettes, and burettes. But these instruments have in many cases not even been made by the same maker. Now it is a well-known fact that chemical weights need not be of a standard weight, but may be considered sufficiently accurate as long as they agree in their divisions. As they are made on that understanding, it follows that the weights used by one maker for standardizing volumetric instruments may be considerably lighter or heavier than those used by another maker. The consequence is that the discrepancies in measuring instruments are very considerable. If only each maker would put his name or trademark on his goods, a great point would be gained; as matters stand at present, it is possible that one may have an assortment of measuring instruments each of which has been made in a different place and been standardised on different weights.

It is not generally known in this country that most litre flasks coming from Germany are standardised on a wrong principle established by Mohr, and are about two-tenths per cent. wrong, even when correctly standardised on that principle. Pipettes are considered sufficiently accurate if correct to two-tenths per cent. between 1 and 25 c.c., and one-tenth per cent. between 50 and 2,000 c.c. This if they are made by one and the same good maker; if made by different makers they will of course vary more amongst each other. Burettes are still more unreliable, as they are graduated on the assumption that the glass tube must be of the same diameter throughout. It is clear that even the best of these instruments are not accurate to within one- or two-tenths per cent., and will affect our work to that extent. Though this does not matter in rough control work, it is too great an error in analyses which require the greatest accuracy. We can certainly get over this point by checking these instruments for ourselves; but few have time, fewer even the necessary instruments to do so. It would be most desirable if some public body, as, *e.g.*, the Royal Physical Institute of London, were to take up this matter, and do for the chemist in measuring instruments what Kew does for the physicist and mariner in thermometers and chronometers.

If matters are bad enough in ordinary volumetric analysis, they are worse in gas analysis; for whereas in volumetric analysis it is generally sufficient if the instruments are accurate amongst themselves without reference to standard weights, in gas analysis it is necessary that weight and volume should agree, *i.e.*, that 1 grm. should be equal to 1 c.c. But as the maker of the gas burette may have used weights differing materially from ours, the discrepancy will be in many cases serious.

We have so far considered the general errors by which analytical results may be affected. We may now examine a few special points appertaining to gravimetric and volumetric analysis. Taking gravimetric analysis first, we find that most of its methods aim at producing an insoluble precipitate which can be easily separated and weighed. But the insolubility of a substance is only a relative property, which depends on the medium in which the substance is placed; and therefore, however carefully a method may have been worked out, it will only be accurate, if in using it, the same conditions are always observed under which it has been established. Thus chloride of silver, the basis of all chloride determinations, is insoluble in water, but the presence of certain ammonia salts makes it more soluble and interferes with the accuracy of the test. Barium sulphate is variously put as being soluble in from 43,000 to 800,000 parts of water, but boiling HCl and HNO_3 have a marked influence on its solubility. Again, some salts are thrown down along with precipitates, and adhere to them to such an extent that they cannot be washed out completely. Naturally, these facts tend to influence the accurary of any analysis, and must require careful attention in each case.

Where volumetric analysis depends upon the principle of creating an insoluble precipitate it is subject to the same errors as shown above for gravimetric analysis. A very accurate volumetric test, if properly carried out, is the test for chlorides by means of silver solution with chromate as an indicator; but it has been shown that this test in the presence of nitrate of ammonia is quite inaccurate, as that substance affects the solubility of silver chloride very materially. Whether, however, the volumetric test depend upon precipitation or not, it nearly always is dependent on an indicator, and it is most important to know the degree of sensitiveness of the indicators used. Thomson has given a table for showing the sensitiveness of a number of indicators. A more complete table has been elaborated by Tromsdorff, and may be found in Böckman's standard book on "Technical Methods of Analysis," which unfortunately has not appeared in an English edition.

Having considered some of the most important errors which may influence the accuracy of our work, we may consider how we may avoid or counteract these influences, so as to reduce the limits of our errors of observation to a minimum.

Taking gravimetric analysis first, we must, to start with, be clear as to what is the principle on which it is based. It is in most cases this, that we convert part of a compound *a* to be analysed into another *b*, which can be conveniently separated, and judge by means of our atomic weights from the quantity of *b* obtained how much of *a* we had to start with. Thus, to take an imaginary instance, if we wanted to determine the quantity of sodium sulphate in Glauber salts we should precipitate with $BaCl_2$, and weigh the barium sulphate. If we obtained *m* grms. of barium sulphate we should say: As the greatest chemists have found that on an average 232·68 grms. $BaSO_4$ are equal to 141·81 grms. Na_2SO_4 mgrms., $BaSo_3$ must be equal to $\frac{m \times 141\cdot 81}{232\cdot 68}$ grms. $= m \times 0\cdot 6095$ grm. Na_2SO_4. Now this reasoning appears to me quite fallacious. If the greatest chemists have found that proportion, differing amongst themselves by perhaps 1 per cent. or more, though working with the best instruments, calculating everything to vacuum, and taking as much time over their work as they like, what is the probability that I, not possessing their skill, working with more imperfect instruments, and being pressed for time, should get the same result? And supposing I were to get the same results as one of them, it might still vary 1 per cent. or more from that of another. Should we not be more likely to arrive at the truth if we were to examine in each instance what is our own individual error, and adopt for it a correction which in each case would be a constant factor. Thus, *e.g.*, if we were to find that 1 grm. pure Na_2SO_4 gave us 0·607 grm. $BaSO_4$, or 99·6 per cent. of what we should have got according to the calculation based on atomic weights, should we not be justified in dividing all the results of similar tests by 99·6, and take those results as correct? I have come to the conclusion that where the highest degree of accuracy is required in technical analysis, this is the only course open to us. For in doing so we not only correct any errors due to atomic weights, but also such errors as may be due to the imperfection of the instruments used, and any errors which may be due to the methods themselves. But if we adopt this corrective method as a general principle, we must be very careful that we do not introduce any fresh errors into our check tests. The first point to be considered is this, that the substances employed for check tests must be as nearly absolutely pure as possible. The second point is this, that the check tests must be carried out under exactly the same conditions as the analysis of the sample to be analysed. Thus the strength of solutions, the quantity of precipitant used, the quantity of wash liquors, and the actual weight of the final weighing must be kept as nearly as possible to the same amounts. If, *e.g.*, we have used 1 grm. of pure sodium sulphate for our check test, and want to test a good sample of salt-cake, we shall get results near enough to the truth if we weigh out 1 grm. of salt-cake for our test; but if we had a mixture, *e.g.*, of sulphate of soda and nitrate of soda, containing about 50 per cent. of each, the check test would have to be performed on a similar mixture of the pure ingredients. For it does not follow that the sulphate in this mixture would yield the same amount of barium sulphate as would a proportionate amount of pure sulphate without nitrate. It appears to me, that it is, to a great extent owing to facts of a similar kind not receiving sufficient attention, that attempts at establishing standard methods have so far not met with the success they deserve. Taking, *e.g.*, the determination of sulphur in pyrites, is it likely that in using, on the one hand, nitric acid for oxidising, and, on the other hand, oxidising soda salts (by fusion), that the errors in the subsequent determination of barium sulphate will be the same, considering that in the one case we have a large amount of iron in solution, in the other case a large amount of soda compounds.

The general principle of check tests applies even more forcibly to volumetric and gas analysis, as the errors to which these tests are subject are more varied than those of gravimetric analysis. The titrating solution should be standardized, wherever practicable, on the actual substance which has to be determined. Thus, acid which is required for testing soda ash should be standardized on pure carbonate of soda; and if we have standardized our acid in such a way that we took 50 c.c. for the original (check) test with pure carbonate of soda, the weight of soda ash or substances containing carbonates should be so chosen as to take as nearly as possible 50 c.c. of acid for each test. Unless we do this we cannot get over the errors which adhere even to our best methods and instruments, and the nearer we keep to the same conditions as between the check test and the actual test the more accurate will our results be. The different degree of sensitiveness of the indicators used should be corrected either by calculation, check test, or, best of all where practicable, by compensation. In testing, *e.g.*, chlorides by means of silver solution, with potassium chromate as an indicator, it will be best to first add the chromate to the necessary quantity of water, then add silver until the red tint to which one works is obtained, and then the weighed-out substance in which the chloride is to be determined; in this way the quantity of silver required by the volume of water and chromate has been compensated from the beginning.

I have endeavoured to show the causes which interfere with the accuracy of our work, and to briefly point out the means by which we may extend the limits of accuracy in technical analysis and reduce the errors to a minimum. These errors will be most prominent in such substances as occur in commerce in a very pure state. Nitrate of potash, chlorates, sulphate of potash, and similar chemicals, which in some cases are almost chemically pure, will not show the actual amount of purity if tested directly for the quantity of chlorate, nitrate, or potassium. In many cases we may now get over this difficulty by determining the impurities and assuming that the difference must be whatever substance it is supposed to be. This, except when done by the manufacturer of the article, is always risky, and wherever practicable the main substance itself should be determined. What mistakes may be otherwise made is clearly seen in the case of nitrate of soda, in which generally only certain impurities, the so-called refraction, is determined, and in which for that reason potash salts and perchlorates have for many years been overlooked. In all these cases the method of check tests will give results more reliable than those obtained by difference, and more correct than those direct tests which rely on the absolute accuracy of our atomic weights, and do not make an allowance for constant, incidental, and personal errors.

The limits of accuracy in technical analysis depend upon the errors which are inherent to our work; the more we can eliminate these errors, the more accurate will our work become. That these errors may become considerable every chemist must have experienced. That they can be eliminated by check test I have unconsciously shown myself many years ago, long before I was myself clear on the different causes of these errors. On working out a method of titrating salt-cake (Chem. News, XLI., 114) I could not get results to account for more than 98·7 per cent. of the total pure Na_2SO_4 used for the check test; but this factor being practically a constant, I considered even then that it would be advisable to accept that fact, and divide all my results by 0·987. I trust that the suggestions I have thrown out may induce you to try the method of check tests where you might not otherwise have done so. It will in every case improve the result, and even where you may consider the accuracy you obtain at present sufficient, a further step in the direction of accuracy can only be beneficial. For ours is a progressive science, and the more accuracy we strive to obtain the more shall we be able to help in its progress, and if but for that reason we should aim at correcting, and thus reducing to a minimum, those errors which limit the accuracy of our work in technical analysis.

Newcastle Section.

Meeting held in the Chemical Theatre of the Durham College of Science, Thursday, November 16th, 1899.

MR. N. H. MARTIN IN THE CHAIR.

CHAIRMAN'S INAUGURAL ADDRESS.

My first duty is to thank you for the honour you have conferred upon me in electing me to be your chairman.

Before proceeding with the address, which our secretary has assured me is the penalty of my promotion, I should like to congratulate the Section on the successful meeting of the parent society in Newcastle this year. It may be that during the time which has elapsed since the visit of the Society in 1881 certain chemical industries have suffered, but I am sure that our guests have carried away the impression that the general industrial activities of Tyneside have enormously increased, and that they have not even yet reached their full development. The programme for the meeting was so full, that it was impossible to do more than take the members in the most cursory way over the works which were visited; but those who were able to inspect the chemical department of this college, as well as to look into the laboratories of the various works, would learn that chemistry, pure and applied, still takes a very active and important part in the industrial development of this district.

The fact that many of our members are learned specialists in education, and in every branch of technology embraced by our comprehensive Society, has made it difficult for one who is neither learned nor a specialist to prepare an inaugural address. Almost every subject has been so elaborately dealt with in the pages of our Journal, that it has been a matter of no small anxiety to select one upon which to address you. It happens, however, that during the past twenty years or more my private and public work have given me exceptional opportunities of observing many educational methods and their results, in this and other countries. I have therefore—trite as the subject is—decided to give you my views upon education in relation to competition. It will be admitted that during the closing years of the nineteenth century no subject has occupied so much public attention as education, and I think it will be equally admitted that, in the vast majority of cases, those who are talking and writing about education as a national question are advocating it as the means of combating the commercial and industrial competition of other countries, especially of Germany and America. We hear a great deal about our imports from Germany, but rarely in any public utterance or paper is there any allusion to our exports to that country. As a matter of fact, the latter exceed the former by many millions a year, and have grown simultaneously with Germany's increase of population and prosperity, and consequent purchasing power. Our imports from America are, of course, enormously greater than our exports; but if we exclude from the former food, cotton, petroleum, tobacco and timber, then our exports to America even run the imports from that country very close, notwithstanding the cordon of high protective tariffs stretched in all directions around the American manufacturer. Our exports to all countries are largely made up of the products of highly-skilled labour, whereas the imports from other countries are mainly raw materials which we must obtain for our factories, and luxuries which we are rich enough to be able to afford.

It is asserted that these countries especially, and many smaller countries, are overtaking us because of the superiority of their technical education, meaning by this a training in applied science, which is imparted by men who are professional teachers in scholastic and academic establishments. We are told that our industries have suffered, that some are on the wane, and some have disappeared altogether, because our land is not covered from end to end with technical schools; and we are urged to follow the example, not only of America and Germany, but of such countries as Switzerland and Sweden, and even far-off Japan. How far does the often-repeated, and, I am afraid, widely-believed, statement that England has had no technical education in the past accord with facts, and how does it come about that during the century which is rapidly drawing to a close she has built up the colossal business, which for the Empire now amounts in imports and exports to nearly 1,375,000,000*l*. per annum, and that the annual revenue of the Empire is 257,000,000*l*.? Strange success to have arisen out of the ignorance of commercial and technical subjects which our educational enthusiasts tell us has been the condition of our benighted country! But is it true that education, general and technical, has been so much neglected? If we go back to the first half of the century we shall find that England was the pioneer in the great inventions which have entirely altered the conditions of modern civilised life; in England the vast potentialities stored up in coal, iron, lime and water were first unlocked; in her factories and workshops the thousands of small inventions and adaptations of which necessity is the parent were accumulated, and England became the technical university of the world. This was made evident by the exhibition of 1851, and the nations which visited England in that year realised that they must come to England for instruction. They did so, and when the Royal Commission on Technical Instruction, which was appointed in 1881, visited the schools and workshops in the United Kingdom, and of other manufacturing countries of Europe, with the advantage of being able to examine employers and employed, teachers and taught, in all kinds of skilled labour, they were able to report: "Our enquiry showed very clearly that the modern manufacturing systems of every country are modelled on those of England. In many instances we found that factories had been designed and furnished throughout by English machine makers, while many foreign manufacturers had been *taught their trades* by Englishmen. All the best machinery that we saw was English, or had been copied from English, and this applied to most of the machine tools in foreign workshops." "In matters of organisation, labour-saving appliances, &c., our imitators have followed us so closely that the best continental factories approach very nearly to our own." This was what was found in the later eighties, but the same thing has gone on even to the present time. During the past few years Germany has been making great progress in the art of shipbuilding, but her shipbuilders acknowledge that it is not so much due to her technical schools or to her superior education as to the fact that they have as models the experience and the organization of our English shipyards, which they frankly admit they are copying. Herr Rudolph Haach, in an article written this year on the development of shipbuilding in Germany, concludes by saying: "It is a pleasant duty to admit that without Britain as a teacher no such rapid success could have been made."

The danger of England belittling her past educational advantages and achievements is twofold; in the first place, it serves to concentrate public attention on one aspect only of foreign competition, and in the second place, there is actual risk that in pursuing the shadow of education we may lose the substance of the business which has been built up and bequeathed to us by our forefathers. It is often insinuated that this or that industry has suffered through lack of technical knowledge, but no account is taken of the interference of trades unions, not only with rates of wages and working hours—although these would be enough to place us at a disadvantage—but with the details of work inside the factory; of disputes between labour and capital; of excise regulations; of protective tariffs; of bounties given by some governments; of patents; of the interference of misguided philanthropists with research; of rates of wages and hours of labour; of the cost and transport of raw materials; of the cost of living and so forth. All these are of the highest importance in relation to the question of foreign competition, and any one of them may affect the well-being of some particular industry in a far greater degree than can be explained by questions of education, general or technical.

I will give you one or two examples. In one department of chemistry, *viz.*, the manufacture of vegetable alkaloids, certain organic compounds and medicinal chemicals, where the use of duty-free pure spirit has turned the scale, Germany has been allowed to accumulate over 20 years of theoretical and practical experience which has been denied to England. Where the question of the use of spirit duty-free was no part of the problem, as in the manufacture of morphine, chloroform, &c., Germany has never been able to compete with English manufacturers. I could give you a list of substances affected by this cause alone, each of which is a small affair when compared with the alkali industry, but making in the aggregate a large portion of the volume of chemicals, the manufacture of which is credited to the superior chemical education of the German.

There is one substance which was affected by a kindred customs-house regulation, but in which a wiser counsel turned the tables. When caffeine was first demanded in large quantities, it was practically all made in Germany, and no English maker could compete in price; at the same time large quantities of tea not worth paying duty on were sent from London to the Continent and sold to the Germans. Owing to the exertions of the London Chamber of Commerce, in which two of our past presidents (Mr. Howard and Mr. Tyrer) took an active part, the Government allowed the tea to be denatured by the addition of lime and sold to our chemists at its then value. From that time Englishmen have held their own in the manufacture of caffeine and its salts.

In the manufacture of aniline compounds, the Germans have decidedly gone ahead of us, but here again it was not wholly a matter of education, although the experience to which I have alluded and the demand for certain kinds of chemical knowledge may have helped them. The discovery of aniline dyes was made by a distinguished member of our Society, Dr. Perkin, and works on a commercial scale were started, but again excise regulations, and other difficulties not of an educational kind, killed the industry before it was well established. There are signs, however, that in the near future Germany will not monopolise the aniline industry, although she must for a long time continue to reap the reward of having been foremost in the field.

Amongst synthetic remedies antipyrine was controlled by a German patent and was a great success, but its very success has proved a snare to German science. Hardly a month passes but that some new substitution compound with a trivial name to indicate its alleged medicinal properties, and a scientific name intended to suggest profound research, is introduced to English medicine. They come with laboratory and medical reports attested by men with university degrees, couched in language calculated to deceive the very elect, but the touchstone of practical trial reveals how science has been prostituted to commercial ends, and the substances, one after the other, pass into oblivion. Such experience serves to bring discredit upon chemical novelties introduced from Germany, and suggests the thought that when science ceases to pursue truth for its own sake, and becomes the badly-paid slave of commerce, its deterioration is inevitable.

With regard to the disputes between labour and capital, and their effect upon competition, it is a matter of common knowledge that such disputes have first crippled and finally driven away industries from certain districts, and not infrequently to some foreign country. That such misunderstandings still exist as a powerful factor in curtailing our industrial expansion is shown by Lord Kitchener's speech made at the opening of the Atbara bridge. He says, "In November and December every effort was made to place the order for the superstructure in England, but it was found impossible for British firms to supply so big an undertaking in the time allowed. This matter is one of considerable regret to me personally. I think it demonstrates that the relations between labour and capital in our country are not such as to give sufficient confidence to capitalists to induce them to run the risk of establishing great up-to-date workshops, with the plant necessary to enable Great Britain to maintain her proud position as the first constructing nation of the world." I am quite aware that anonymous writers have attempted to minimize this statement of Lord Kitchener, by suggesting that the specifications issued were not fair to English contractors, but he had many other large business transactions with England, and it is fair to assume that the general impression he derived from his experience was, that the relations between labour and capital are not of a satisfactory character and are inimical to English manufactures.

Our Commercial Attaché in Berlin writes in his report, in December 1898:—

"In these days of keen competition it is impossible to realise the amount of the indirect losses to commerce caused by unfortunate and protracted disputes between employers and workmen, which gratuitously hand over portions of trade to the eager foreigner, all too ready to grasp them."

With regard to trades unionism, I do not know enough of it to estimate its effect for good or evil on the larger industries of the country, but there are industries which I know do not lend themselves to some of its methods. When specialism, versatility, readiness of resource—in a word, individualism—comes into play, the iron grip of the mechanical rule from outside has destroyed the industry. This is notably the case in some of the departments of the glass trade.

Referring to the hours worked in Germany, in one small technical branch, I am assured by the employer that his men would strike if they were not allowed to make twelve hours per day on six days in the week and six hours on Sunday.

Another cause of anxiety may well be some of the directions in which private ownership is giving way to limited and joint stock companies. Private ownership and practical knowledge associated in the same individual, or in a small group of persons working together, has been in the past the keynote of our industrial success. Can it be imagined that many of our great industries would have reached their present condition if at the commencement the inventor and pioneer—the builder—had been exploited for the benefit of private speculators or gambling syndicates?

Time would fail me to go into detail with regard to the other causes of interference which I have enumerated, but I hope I have said enough to prove that the parrot cry of imperfect education on our part is not to be accepted as an adequate explanation of all the success which our competitors may have won over us.

Having said so much, let us now consider the question of education in relation to the industries of this country and the competition which the very success of those industries has evoked. There are two sets of men, the theoretical and the practical, who are interested in this question, who hold quite distinctive views with regard to the best way of preparing the individual for his share in the work of the nation. The theoretical man holds with some show of reason, that the way to get the highest type of workman is to give every individual a sound theoretical basis of the principles which underlie his work, and that it is best to train the workman how to work before you allow him to take his share in actually doing it. Men of this class were fortunately at the beginning of the century, and still are numerically the smaller number; but, owing to their capacity for talking and writing, they have gradually increased in importance, until now there is quite a serious number of men withdrawn from useful labour, who are prepared to teach others how to do things; but whether more than a fraction of them could actually do the things they talk about is open to question. The danger of the rising generation receiving their industrial education from such a source is that unconsciously a habit of mind is created which is averse from receiving knowledge from practical sources, and which overestimates that which can be obtained from the book or the lecture, even if it does not produce a contempt for the great body of practical knowledge which exists. On the other hand we have the practical man. He is not as a rule a great talker, and rarely does he seek opportunities to state his views—he is too busy doing things—but when all is said and done, when the lecturer and the teacher have done their best with their theories and their make-believe practice, the actual work must pass into the hands of the practical man, and I think it is wise to take counsel with him at the start how best to train the workers. We have in our own city the highest type and one of the most brilliant examples of the practical man known to the English speaking race. He belongs as a part of history to the great industrial success of this century, and he has himself told us, in two papers published in 1888, his methods and the secret of his success. I therefore think no excuse is necessary for introducing the name of Lord Armstrong in this connection. He tells us at the conclusion of his second paper on "The Cry for Useless Knowledge":—"I never had a scrap of instruction bearing on my profession beyond what I imbibed for myself, and that I feel has done me incomparably more good than if it had been administered to me." He also tells us of the qualities which were looked for in the men who were selected by him to aid him in building up his business, and mere book knowledge was not the dominant one. "Nature," in reviewing these papers spoke of Lord Armstrong as belonging to "that remarkable genus, the practical Englishman who has been the glory of his race in the past, but threatens to be its destruction in the near future," and concluded by saying: "If the majority remain much longer of his opinion then is the fate of our nation sealed." This was written in November, 1888, a decade has elapsed, and I think every shareholder will endorse the view that the consummate wisdom of Lord Armstrong's methods is still seen in the phenomenal success of the great industrial corporation he created.

Education may very conveniently be considered as general and specific, general education having to do with conveying the rudiments of knowledge, cultivating the intelligence, and providing the individual with the tools with which he can increase his own store of knowledge, thus making him fit for the reception of specific education. General education is, in my opinion, the only branch in which the State should actively interfere. Specific education has to do with the knowledge and experience the individual must acquire in order to gain his own livelihood, and to take his part in the various activities around him. This is best acquired in the environment of the home, the factory or the workshop. If the attempt is made to impart this knowledge in schools and colleges instead of in homes and workshops, there is the danger that, as the schools can only teach a small number of the multitudinous trades that are practised in this country, a transient artificial taste is created in the individual, which renders him discontented with what would otherwise have been his natural lot. Too many workers (or idlers) crowd certain callings, and their services cannot be utilised, while other industries suffer from lack of workers.

With regard to primary, or, as I prefer to call it, general education, it has become so much the fashion to think and talk of it as solely a means to an end and not as a good in itself, that even so thoughtful and practical a man as Sir Andrew Noble, in his recent address, puts this idea into shape in the following words:—"In nine cases out of ten, I should say, any knowledge acquired by a boy before he is 16 can have but a slight intrinsic value. Up to that age it is not *what* he learns that we have to look at, but *how* he learns; it is the habit of discipline, of mental application, of power in attacking a subject, that are so valuable; not, generally, any definite piece of knowledge he may have gained." I agree with Sir Andrew Noble as to the value of the discipline, but I join issue with him and all those who think it is of small importance *what* is taught during the early life of the child. The opportunities that childhood offers are unique, and I cannot but think that it is a matter of vital importance that we should most carefully consider the kind of knowledge which we are going to impart as well as our method of doing it. It is the combination of the two that will be necessary for the evolution of high ideals and sound character.

Let us see how school boards, under the guidance and control of the Education Department proceed to administer elementary education. The children are received into the schools at three years of age, and are compelled to come at five. From the first day the mechanical drill begins, and all individuality, initiative desire, and creative instinct are trained out of the children. I have watched the process, and in its earlier stages I am bound to admit it looks attractive; but soon the effect of drill on the immature brain begins to tell, and by the time the second or third standard is reached the individual pupils have in many cases ceased to learn, but collectively they are being taught; and the terrible anxiety of the teachers is that the impressions the children receive shall survive the ordeal of the inspection and examination which is ever in front of them, and, what is of even more importance, that each pupil shall earn the highest possible grant in money. Under this system the school boards, instead of confining their work to subjects which will improve the mind and raise the general intelligence of the pupils, branch out into "grant earning" specific subjects to the neglect of true education. Everybody knows there is no teaching more hollow, more utterly destitute of real educational value than that for which grants are given under the name of specific subjects. In connection with our elementary teaching no plan more vicious than payment by results and for attendances could have been devised. Through it a scholastic despotism has arisen and is being exercised under which parents dare not withdraw their children from official teaching for a single hour, however pressing the domestic need, whereas the child may be occupied in school at that very time in make-believe work of the same kind to earn grants for the board and the teacher.

I will, as briefly as possible, indicate what, in my opinion, should be the subjects of sound elementary education. Children should be taught to read, not merely to recognise words and pronounce them properly, but to understand their various meanings and true value when combined in good English literature. Everything is possible to the intelligent child who has learnt to read and whose mind has been directed into the right channel as to what to read. There need be no narrow selection of subjects; for our purpose we may use books of poetry, prose, biography, history, travel, &c. Every child who is capable of receiving instruction through the avenue of books will find something to stimulate the imagination and to inform the understanding.

The next subject is writing, and I claim for writing, taught as it should be, that it is the most subtle and effective means we have of training the eye and hand to act together in obedience to the brain. In the upper standards drawing should supplement writing, as it is of almost universal utility. When the young student has given evidence over a sufficiently prolonged period that he can write long hand legibly and rapidly, and can in so doing spell words correctly, shorthand would very advantageously complete this branch of education.

Arithmetic is a subject which should be more thoroughly taught than it is. It is not only the basis of commerce, but forms a necessary introduction to the higher branches of mathematics, which are the foundation of exact physical and chemical science. If taught thoroughly and in a proper manner from the beginning, there is no subject more fitted to train the mind of the pupil in the habit of concentrating his thoughts, a quality of the greatest value in approaching any difficult subject,

Geography is a fascinating subject and should include some account of the great explorers who have opened up hitherto unknown countries, something of the political conditions that obtain in different nations, and a description of the chief natural productions and advantages of various lands. How much this would help to clearer understanding of why this or that country can do or supply something better than another, and how dependent on each other are all the countries of the world!

The State having assumed the responsibility of educating the children should not neglect the subject of history. It seems to me a grievous mistake to place in the hands of the rising generation great powers of self-government and of interference with the affairs of each other without, at the same time, giving them a good general knowledge of the history of their own country, and, as far as possible, of other important nations. I fear there is a tendency to depreciate the teaching of history as if it were merely a list of names of people who have long since ceased to be of interest, and whose personal characteristics were of small concern to the men of our day. But it is only on the sure ground of the teachings and lessons of the past that anything approaching a correct judgment can be formed upon the problems of the present. Such knowledge would help to prevent unnecessary repetitions of crude experiments in individual conduct and national government.

I should like to state my own deep conviction that it is a grave national misfortune that the teaching of the Bible has been relegated to such an obscure position in our system of general education. Apart from controversial or theological aspects, the thoughtful study of the grand truths which abound in the pages of the Bible will form a sure foundation for that which is above all price—sterling character. It is admitted by all who are competent to judge that England has had the finest workmen in the world. I think the individual character of the workman has contributed largely to this.

In teaching these subjects which I have briefly outlined as being alone of importance in elementary education, I would plead for a well regulated sympathetic method which would tend—without interfering with systematic training—to draw out and develop any instinctive talent which the individual child might possess. It is difficult to precisely define what one means by "initial tastes" or "original bias." But everyone will agree that there does exist in many, if not most, children, some strong natural inclination toward a particular ideal which is liable to be lost sight of in simply mechanical methods of education. This would explain the apparent anomaly sometimes presented of a boy who has been thought dull at school astonishing the world in after life as a brilliant inventor, intrepid explorer, or great naturalist. There should be no attempt to teach natural science in connection with elementary education; because it is impossible to teach any branch of science effectually until the pupil has learnt to use accurately the means by which ideas are communicated from man to man, and because, when education has been brought to this stage, it must necessarily fall to the lot of the great majority to go out into the world to earn, or help to earn, their daily bread by actual manual labour. In an old country such as ours, with its multifarious occupations in full swing, the technical education necessary for the rank and file of the workers is best carried on in the actual occupation each one may select.

In Japan, a new country, they have perhaps wisely set up commercial schools, and in higher form, we are told by Mr. A. H. Lay, Assistant Japanese Secretary at Tokio, "students are taught all the every-day methods and forms of Western business by actually practising them in a large room, in a make-believe way, but with exact observance in detail, &c." One part of a room is fitted as a bank, another as a customs' house, imports and exports are entered, bills of lading prepared, bills of exchange negotiated, and so forth, and it is all "carried on in compulsory English." In the following paragraph, Mr. Lay very pertinently observes, "but though the programme is splendid, it strikes one as being too theoretical. In such games one cannot practice common sense, judgment, patience, readiness to risk, and other essentials of actual business." We in England have a vast amount and a great variety of "actual business" to do. Is it wise for us to create in our midst a number of make-believe institutions to convey the knowledge while the business to be done is neglected for the lack of intelligent and disciplined labourers?

Whilst I think the above is the limit to which the State or public bodies should go in providing education free, there are two further stages of education which should be accessible to those who can afford to pay for it or to any who might win, during the period of elementary education, scholarships to be given for evidence of marked ability and industrious study, rather than for mere capacity to remember a series of facts. The first stage of this higher education should be devoted to taking the pupils further in the subjects of elementary education, with the addition of higher mathematics, ancient and modern languages, and when desired a sound *elementary* teaching of certain branches of natural science. To undertake to teach science on any other basis than that of a thorough general education, is like attempting to build a house without laying the foundation. Those who are advocating it are either ignorant of the subject, or they are men who are so enamoured of science themselves that they forget how much their own early education and general culture have contributed to their understanding and enjoying it. The object of this stage of education should be to fit some men for the more responsible positions in offices or workshops, and to prepare others for the final stage of theoretical education—the university. It should be paid for by those who are benefited, because it should qualify the recipients for labour which would be more highly remunerated, and also because no encouragement should be given to boys to indulge a vacillating spirit on leaving the elementary schools.

The final stage in education must be at the university; and although the training which is given here should in my opinion be confined to numerically a very small number of persons, it is not possible to exaggerate the necessity for or the importance of the work to be done in our university Colleges, if we are to have men properly equipped to understand the principles upon which so much of our manufacturing depends. The building and equipment of colleges, where the most learned professors of all branches of physical science are engaged in teaching, in all our great centres of population and industrial activity, should be the supreme care of much private munificence; and where this has failed, national money might well be spent in providing the buildings and their furnishings. The entrance to these colleges should be through an examination in general knowledge practical and severe, as, unless the pupil gives evidence of having acquired disciplined habits of thought and work, and of possessing a sound acquaintance with mathematics and general subjects, the mind cannot assimilate the teaching which alone should engage the attention of our universities. To employ men of deep learning to cram hundreds of badly-trained and ill-informed students to pass examinations, and to obtain useless degrees (useless, because under modern conditions, they are no guarantee of real learning), is an insult to our professors and an economic waste which only a rich nation could afford. I do not need to sketch in any detail the course of education, but to whatever branch of learning the student elects to devote his energies, his studies should be so prolonged and thorough, that when he receives the recognition of a university degree, this should of itself be indisputable evidence that the possessor was a man of sound and deep knowledge and trained capacity. If I were asked to fix a time for the duration of such studies, I should say that four or five years should be the least time to be devoted to the acquisition of the necessary knowledge for such a degree. I am quite sure that no man of average intellect could receive an adequate training in chemistry, and the essential collateral subjects, under five years; and these years should be preceded by the training in general knowledge, and especially in mathematics, which I have indicated in the second stage of education. It is here where the Germans beat us, they devote much longer time to the higher branches of education, and hence they produce a larger percentage of really well-trained experts. Above all, the work of our university colleges should be so arranged that the eminent men who are the professors of pure science should be adequately paid according to the intrinsic value of their work, and they should have time at their disposal to pursue further and deeper each his own department of knowledge. Much of the so-called research which is encouraged and paid for by publicly elected bodies is nothing more than the repetition of crude and elementary experiments which have previously been made and judged by practical men in the pursuit of their own business, while we neglect what should be the sources of real research in the persons of our greatest experts surrounded by small bands of highly trained and enthusiastic students.

My text has been education in relation to competition; it has been difficult to condense so large a subject into the reasonable limits during which I might occupy your time. I have thought it necessary to direct attention to other important factors in the competition of our rivals for the world's commerce, and manufacturers and I have briefly sketched the direction, and some of the details which, in my opinion, will best fit us to maintain our position amongst the industrial nations of the world.

To recapitulate, education in the first place should be directed to raising the general intelligence of the workers, who should then learn their work by actually doing it in the abundant ways provided by our environment. It should be carried further for those who can afford to pursue it, and to its highest stage by the limited number who can spend the time over it and who are capable of grasping the deep truths of science, and the principles which explain the achievements of the past and which may well form the basis for the discoveries of the future. At every stage thoroughness should be the dominant note, and everything tending towards superficiality and cram should be avoided. Honest work everywhere!

If this is carried out I have no fear but that England will continue to produce men of genius, honour, courage, and perseverance to perform and dignify the laborious task of maintaining the greatness of the British Empire throughout the industrial world.

New York Section.

Meeting held at the College of Pharmacy on Friday, October 20th, 1899.

THE PRESIDENT (PROF. C. F. CHANDLER) IN THE CHAIR.

THE DEATH OF MR. H. Y. CASTNER.

The President said: It is with deep sorrow that I announce the death of Mr. Hamilton Young Castner, one of the most distinguished members of the Society, which occurred on Wednesday, October 11th, at Saranac Lake, New York.

Mr. Castner entered the School of Mines of Columbia University in the autumn of 1875, and devoted three years to the study of chemistry in all its branches, under my special direction. He left the school at the end of June in 1878 and entered at once upon the practice of industrial chemistry. Mr. Castner possessed the mind of an inventor, and has been extremely successful in devising new and ingenious processes which have found extensive application in practice. It would take too much time to recall all the valuable improvements made by him, but I think you will grant me time to refer to a few of his most important achievements.

In the autumn of 1885 he invented the improved process for the manufacture of sodium of potassium, which immediately gave him entire control of this industry as well as of the manufacture of aluminium by means of cheap sodium. His American patent for this process is dated June 1st, 1886. Prior to this time all the sodium of commerce was manufactured by the old process in which carbonate of soda was reduced by finely divided carbon in the presence of lime in small iron retorts, at a very low temperature. The price of the sodium was about 2 dollars per pound. As all the aluminium was at that time manufactured by reducing aluminium chloride by means of metallic sodium, and as at least 3 lb. of sodium were required for each pound of aluminium, it was not possible to supply aluminium for much less than 10 dollars a pound.

Mr. Castner revolutionised the manufacture of sodium by reducing caustic soda at a low temperature in enormous steel crucibles in a gas furnace by means of carbide of iron, at a small fraction of the previous cost. His cheap sodium enabled him to manufacture aluminium at a greatly reduced price, and thus to largely increase the market for this interesting metal.

Mr. Castner and his associates have, ever since that time, monopolised the manufacture of metallic sodium, and they were the exclusive manufacturers of aluminium until the process of electrolising a solution of aluminium in melted cryolite was devised by C. M. Hall in America. Since that time all the aluminium has been manufactured by this latter process. In 1891 Mr. Castner invented a new process for the manufacture of sodium and potassium by the electrolysis of caustic soda and caustic potash. This electrolysis takes place at such a low temperature that the sodium and potassium no longer rise in vapour, but accumulate above the melted caustic in the cathode chamber of the apparatus, where they are protected by hydrogen gas liberated at the same time, and can be kept and ladled out at convenient intervals. This process produces the alkaline metals at a still lower cost than the chemical process previously invented by Castner, and is now the only process in use. It is practised at Niagara Falls, Birmingham, the Falls of the Rhine at Neuhausen, and, I believe, at one or two places in Germany.

As the sodium process could no longer be employed for the production of aluminium, having been superseded by the electrolytic process which I have already mentioned, Mr. Castner turned his attention to developing new applications for metallic sodium; among these may be mentioned the production of peroxide of sodium employed for the production of peroxide of hydrogen for bleaching purposes and the manufacture of extremely pure cyanide of potassium and sodium, which is largely employed in the cyanide process for extracting gold from low-grade ores. Another application of sodium is in the manufacture of antipyrine.

The American patent for Mr. Castner's electrolytic process for manufacturing sodium and potassium was granted May 12th, 1891.

Another of Mr. Castner's important inventions is the beautiful process for the electrolysis of a solution of common salt for the preparation of caustic soda and chlorine. This is a problem which has occupied the attention of chemists for 30 or 40 years at least, and, I presume, 50 or 100 different plans have been suggested, no one of which proved to be entirely satisfactory. The difficulty of most of the processes arose from the fact that the electrolysis took place in an aqueous solution of common salt. The metallic sodium set free was at once converted into caustic soda in the presence of the salt, so that the product was always contaminated with salt. Besides this, the chlorine reacted on the caustic soda and produced sodium hypochlorite or chlorate. Attempts were made to protect the caustic soda from the chlorine by the use of various diaphragms composed of various materials. The diaphragm proved, however, to be a very imperfect separator, and it also introduced objectionable resistance. Mr. Castner met all of these difficulties by employing a layer of mercury in the bottom of his decomposing cell as the cathode, the metallic sodium being taken up by the mercury as fast as it was liberated. Adjacent to the decomposing cell he placed a second cell separated by a trough under the partition, which was, consequently, filled with mercury. The double cell was mounted in such a way that it could be made to tip about once a minute, just enough to cause a portion of the quicksilver, containing about one-fifth of a per cent. of sodium, to pass from the decomposing cell to a second cell, which contained water and caustic soda. In this cell the sodium was withdrawn from the mercury and converted into caustic soda, which went into solution. The mercury returned to the decomposing cell for a second charge of sodium. In this way the sodium was protected from the chlorine and withdrawn from its sphere of action to be converted into pure caustic soda, entirely free from common salt. The process was made continuous, the salt solution circulating through the decomposing cell with fresh additions of common salt, the chlorine being drawn off to the chambers for conversion into bleaching powder, and the caustic soda drawn off into tanks to be concentrated, if necessary, or sold in solution as it came from the apparatus.

The American patent for the apparatus was granted April 10th, 1894, and the patent for the process October 30th, 1894. This process has proved a great success, and is practised in England, at Niagara Falls, and, I believe, at some other points, and, apparently, leaves nothing to be desired in this direction.

For some years Mr. Castner's health has not been good, and he has spent his winters in Florida. Finding that this climate did not tend to an improvement in his health, he spent the past summer at Saranac Lake in the hope that the climate there would benefit him. It was decreed otherwise, and he passed away, without pain, on October 11th.

Mr. Castner possessed a very sweet and amiable character, and was much beloved by those who came to know him.

intimately. He was extremely modest, and never claimed any particular credit for his very clever inventions. During his illness he manifested the greatest patience and was ever uncomplaining. Mrs. Castner was with him to the last. He left no children.

THE ANALYSIS OF LUPULINE.

BY RUSSELL W. MOORE, M.A., M.SC.

The use of lupuline has within a comparatively short period become of considerable importance in the United States. It is recognised as a crude drug in the Dispensatory, and, as this class of substance is not subject to duty on importation into this country, while hops under the recent tariff laws have been taxed from 8 to 15 cents per lb., it can readily be seen that the bitter flavour of the hop could be obtained more economically by the use of imported lupuline.

The fact that lupuline, up to the passage of the Dingley Tariff which provides for it by name, had been considered a crude drug, rendered it necessary to determine what should be the standard of purity; and as Germany furnished most of the lupuline sent to the United States, the German authorities on this point were of the most importance. The present German Pharmacopœia omits lupuline, but it was included in the former or second issue.

Hager's "Kommentar," in the second edition, required that it should not contain over 10 per cent. of ash, and should give an ether extract of at least 70 per cent. The United States Dispensatory condemned anything beyond 8 per cent. of ash, while the British Pharmacopœia allowed 15 per cent. of ash. The German standard furnishes a fuller knowledge of the quality of a sample, requiring not only the amount of mineral impurities, but also a determination of the soluble or useful portion.

The following results were obtained on various samples of European lupuline. All were samples of new lupuline; that is, less than one year old. The examination was made on 10 grams of the sample by extraction in a Soxhlet tube until a colorless extract was obtained, after which the residue was weighed. This was preferred to drying and weighing the ether extract, in which case loss was always occasioned by volatilisation of the essential oil contained in the lupuline. The ash was estimated by ignition of two grams in platinum.

The following results were obtained :—

—	Ash.	Ether Extract.	—	Ash.	Ether Extract.
	Per Cent.	Per Cent.		Per Cent.	Per Cent.
1	9·50	78·05	14	17·50	66·54
2	9·75	76·79	15	17·75	69·40
3	10·50	76·32	16	19·00	68·28
4	11·00	75·93	17	19·50	62·18
5	12·25	74·20	18	19·50	65·51
6	12·32	73·74	19	19·50	65·51
7	12·75	79·57	20	19·52	62·18
8	13·60	71·90	21	20·00	63·52
9	13·75	71·93	22	20·06	65·90
10	14·22	70·71	23	21·00	66·70
11	14·30	70·95	24	21·25	64·70
12	14·86	68·86	25	24·39	60·62
13	15·00	72·50			

An examination of these results shows that only two of 25 were below the required minimum of 10 per cent. of ash, while 12 were above the minimum of 70 per cent. of ether extract. It is also evident that there is no constant proportion between the ash and the ether extract in commercial lupuline. This is readily explained by the fact that foreign substances attaching themselves to the lupuline consist in some cases of fragments of the hop flower, and in others of sand and other mineral substances, which influence the amount of ash to a greater extent.

Neglecting No. 13, which appears exceptional in its character, it would appear that a percentage of ash amounting to 14·50 would be more just than 10 per cent., as now required.

Discussion.

Dr. V. Coblentz asked if the samples had been submitted to microscopical examinations, and whether the author had found in the examined lupulines other plant extracts. It was claimed by some authorities that other plants yielded substances very similar to lupuline in appearance, and were used as adulterants.

Mr. R. W. Moore in reply said that there had been but little microscopical examination. As they were doubtless aware, the lupuline of commerce was not obtained directly from the hop. It was found after the hops had been handled and was swept out and purified more or less by winnowing. Being a very sticky substance, a good deal of foreign substance adhered to it—sand, and fragments of the hop flour. The product seemed to be tolerably uniform. Some of the poorer samples looked like some other foreign leaves—it was a very curious thing—so that the old or inferior lupuline would have a much lower percentage of ash than the new or finer, which was more valuable; that was because new lupuline was very sticky, and the mineral substances adhered to it, while it could be readily separated in the old.

ANALYSIS OF ASAFŒTIDA.

BY RUSSELL W. MOORE, M.A., M.SC.

The following results were obtained on a number of samples of gum asafœtida exported to the United States. It is only fair to state that they were all sent to the laboratory as samples that were considered deficient in the proper per cent. of resin, samples evidently of high quality being judged by their appearance.

After considerable experimenting the following method was followed :—The sample was coarsely broken and brought as nearly as possible to a uniform condition. It was then quartered down and 10 grms. placed in a paper thimble in a Soxhlet tube and extracted for about three hours with alcohol. The thimble was next dried in an air-bath or water-oven, and the contents then intimately mixed in a mortar with ignited sand. The mortar was cleaned with more sand, and the whole replaced in the same thimble, and extracted as before for about four hours. After this time the substance was found to yield no further extract. In this way the clogging of the paper was avoided, which was almost invariably experienced when the sample was treated with hot alcohol and washed into the thimble.

The regulations of the Treasury Department require the presence of at least 50 per cent. of resin.

Per Cent. of Resin.	No. Samples.	Per Cent.
1 to 10	13	7·93
10 to 15	49	29·88
15 to 20	61	37·19
20 to 25	19	11·58
25 to 30	7	4·27
30 to 35	4	2·44
35 to 40	3	1·83
40 to 45	2	1·22
45 to 50	0	..
Above 50	6	3·66
Total.......	164	100·00

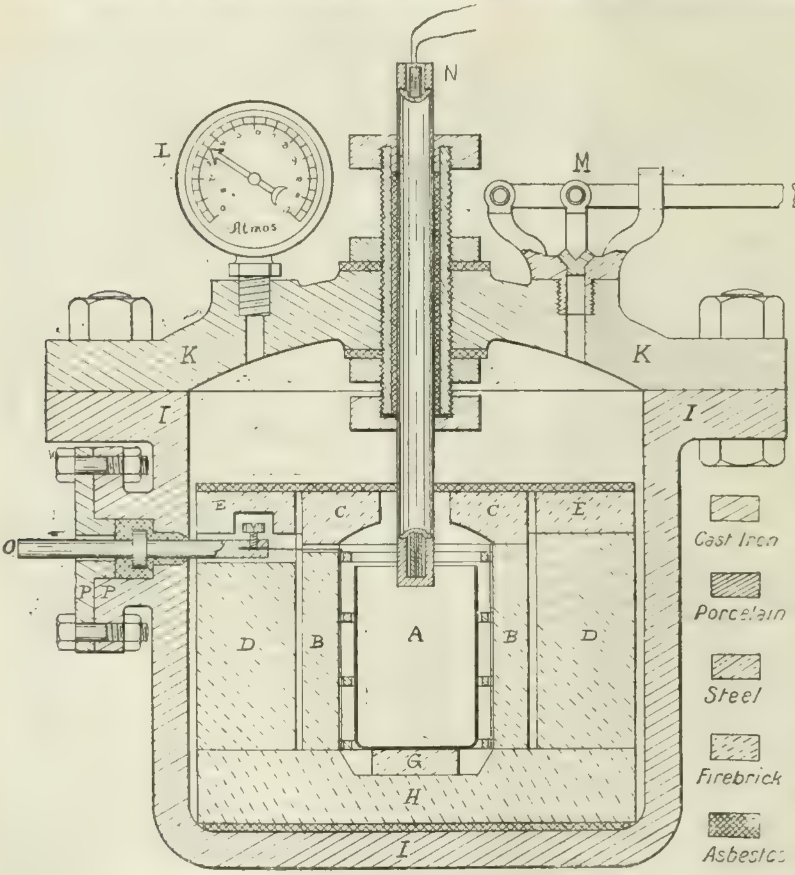
It can readily be seen that much asafœtida deficient in resin is to be found, and that a critical inspection of its quality is necessary.

THE BEHAVIOUR OF ZINC OXIDE AT HIGH TEMPERATURES.

BY ROBERT C. SCHÜPHAUS, PH.D.

The experiments of which a short description is herein given were carried out by Dr. Emil E. Lungwitz and myself, in the electro-chemical laboratory of the Berlin Royal Polytechnic School. Our apparatus is simply an autoclave with such changes as are demanded by the conditions under which we worked. As the temperatures required approach and even equal those obtained in blast furnaces, external heating was out of the question. The only available source of heat for laboratory work of this kind is the electric current. The furnace, as shown in the accompanying drawing, is a cast-iron pot of sufficient strength to withstand a pressure of ten atmospheres, and is lined throughout with fireclay. Two steel electrodes enter the furnace through stuffing-boxes filled with asbestos packing. The ends of the steel rods projecting into the furnace are bored out to receive the ends of a fine platinum wire; two little set screws secure the wire firmly. The platinum wire is strung up and down through perforated rims on the inside of a fireclay cylinder. A crucible of highly refractory unglazed porcelain fits into this cylinder. The crucibles we used were especially made for us, of Hecht's porcelain, at the Royal Porcelain Factory, of Berlin. After the crucible with its charge has been introduced, a heavy fireclay ring and cover with opening for the pyrometer tube are put in their places, and the iron cover of the furnace is screwed on. A ring of asbestos or similar material is placed between the flanges to secure a tight joint. The cover is provided with a safety valve, a pressure gauge, a tube for the inlet or outlet of gases, and a stuffing-box, through which the porcelain tube enclosing a thermo couple passes. When it is desired to maintain a high pressure in the furnace, air is forced in by means of a Natterer air-compressor.

A few words about certain precautions to be taken in working the furnace. To protect the platinum wire from contact with deleterious substances, carbon dust for instance, it is usually sufficient to cut a ring out of asbestos board with an opening just wide enough to hold the crucible snugly, and to press this ring into place. In other cases it is advisable to lute the crucible to the fire-clay cylinder by means of a paste made of clay and ground pieces of burned fireclay, taking care that the wire is covered wherever exposed. The ends leading to the iron electrodes are passed through pieces of clay-pipe stems, and any protruding parts are covered with the paste. By turning on the current the paste dries quickly, and any cracks showing themselves are smeared over with the same mass. It is of the utmost importance not to turn on the full strength of current that it is desired to use at once. By doing so we run the risk of burning the wire out after a short time, while by a gradual increase of current sent through we may obtain very high temperatures. We employed a wire of about 0·6 mm. diameter, weighing 17·1 grms., in 2·5 m. lengths, and had no difficulty of passing a current of 15 ampères, and even slightly more, through for a whole day. It is, therefore, necessary to regulate the current by means of a rheostat. Besides an ampèremeter we always placed a voltmeter in the circuit, the latter being connected in a shunt, so as to have an easy means of measuring the resistance of the incandescent wire. The current at our disposal was of about 120 volts. Where a rheostat is not available, the current may be regulated to the greatest nicety by passing it through a cell containing very dilute acid or alkali. An earthenware trough, such as are used for galvanising baths, is charged with a small quantity of water either rendered slightly acid by means of sulphuric acid, or alkaline by means of caustic soda. The electrodes are lead in the former, iron plates in the latter case. By varying the distance of the electrodes, the depth to which they are immersed and the amount of acid or alkali added, we can regulate the current at will. The furnace is best placed inside a tub so as to allow rapid cooling by a stream of cold water.



A. Porcelain crucible.
B. Cylinder of fireclay with platinum wire strung on.
C. Cover of fireclay.
D. Exterior cylinder (fireclay).
E. Ring (fireclay).
G. Block (fireclay).
H. Bottom plate (fireclay).
I. Pot (cast iron).
K. Cover (cast iron).
L. Pressure gauge.
M. Safety valve.
N. Pyrometer tube.
O. Steel electrode.
P. Stuffing box for electrode.

Dimensions = ⅓ actual size.

Zinc, though used in enormous quantities, is produced after the methods of the laboratory by distilling a small charge from a clay retort. There is nothing of the magnitude and continuity of blast furnace work in this process.

The difficulty of applying ordinary smelting processes to zinc ores is chiefly caused by the close proximity of the temperature of reduction of zinc oxide and the boiling point of metallic zinc. Ordinarily we obtain zinc vapour from the reduced oxide.

It was Dr. Lungwitz who, as the first, in his patent No. 9072 of May 7th, 1895, showed the way out. His process is based on the fact that the temperature of ebullition is a function of the pressure. If the pressure be raised sufficiently within a closed apparatus and zinc oxide reduced therein, metallic zinc must be obtained in liquid form. In the presence of metals that form alloys with zinc, lead for instance, as is the case in the mixed lead-zinc ores, the refractory ores of Colorado, the separation of metallic liquid zinc is much facilitated. Every smelter knows that even iron blast furnaces where zinciferous ores are used have spells lasting for days, and that at such times liquid zinc is tapped with the iron. Lead and zinc form an alloy at red heat from which most of the zinc separates on cooling. When we consider that the temperature of a lead furnace, measured in the slag tapped therefrom, is about 1,034° C., and that, according to Barus's researches (Barus, "Die Physikalische Behandlung und die Messung hoher Temperature," Leipzig, 1892, pp. 42 and 68), the tension of zinc vapour at this temperature is less than two atmospheres, we see at once that the technical difficulties to be encountered are not formidable. Barus determined the melting point of diabas as only 1,170° C., and the production of a slag in practical operations resembling diabas in its composition is not to be thought of.

One constant that it is of the utmost interest to know is the temperature of reduction of zinc oxide. We determined it in the following manner:—When treating a mixture of zinc oxide with carbon in our furnace, with the valves closed, we observed a very decided rise of pressure when the temperature had risen above 900° C., not due to the gradual expansion of the gases, but to the formation of carbon monoxide. It need hardly be mentioned that there is a slight escape of gas from the furnace when these high temperatures are reached; hence the need of pumping up pressure from time to time, when a certain high pressure is to be maintained.

To obtain a more accurate figure the air inlet valve was left open until the pyrometer registered 900° C. On closing the valve the pressure began to rise very markedly at 910°, whilst the pyrometer remained practically stationary for a long time. 910° may therefore be set down as the temperature at which the reduction of zinc oxide by carbon commences.

In heating charges of zinc oxide and carbon in this furnace to temperatures far exceeding 910°, going up to 1,150°, and maintaining a pressure in excess of the calculated tension of zinc vapour, we obtained ingots of zinc at the bottom of the crucible. These experiments prove that liquid zinc collected on the bottom of the crucible, though its temperature was far beyond 930° C., the boiling point of zinc under atmospheric pressure.

When heating zinc oxide and carbon under pressure, we obtained on many occasions large quantities of a powder of a canary-yellow hue. An analysis yielded more zinc than is contained in the oxide. Pursuing the idea that this yellow compound might be a low oxide of zinc, we undertook the following experiments, each of which yielded a body permanently yellow:—

(1.) Zinc oxide was heated in an atmosphere of pure nitrogen.

(2.) Zinc oxide was heated *in vacuo*.

(3.) Zinc oxide, mixed with zinc dust, was heated under pressure.

These experiments render it highly probable that zinc oxide, on heating, loses part of its oxygen, and that the new compound is stable if it is cooled in the absence of oxygen.

Another problem, the production of zinc ingots from commercial zinc dust, usually containing from 8 to 10 per cent. of zinc oxide, is easily solved in our furnace. It is only necessary to add some carbon, and heat under pressure. This process is not only more elegant than the now obsolete Montefiore method, but also yields metal entirely free from oxide, which the latter does not.

Discussion.

Mr. R. W. **Moore** asked if the canary-yellow compound which the author had obtained was a permanent one.

Mr. J. **Prochazka** asked how the author measured the temperature.

Mr. C. M. **Reubens** asked if the electric arc could be introduced in this furnace.

Mr. B. B. **Goldsmith** asked if the temperature in the furnace kept rising by passing 15 ampères into it continually.

Dr. W. **Dreyfus** asked if the furnace could be used for continuous reduction of lead oxide.

Mr. R. C. **Woodcock** asked if it would be possible to produce carbides in such a furnace. The pressure in the apparatus should produce the carbides at lower temperature.

Dr. R. C. **Schüpphaus**, in reply, said that the canary-yellow compound was permanent. He had kept it once in the open air for six weeks, and it had remained unchanged. In their experiments it was heated in the absence of oxygen. The temperature was measured by means of a thermo element, and the measurements were exceedingly accurate; nothing was left to guess-work. It was not high enough to produce carbides. There would be no difficulty in introducing the electric arc into that form of furnace. There was also no limit to the rise of temperature. An equilibrium was established when just as much heat was lost by radiation as was supplied by the current. It would be impossible to use the furnace in its present form for continuous reduction of lead oxide. In order to do so it would have to have an arrangement for continuous charging and tapping.

MICROSCOPICAL IDENTIFICATION OF SOME USEFUL FIBRES.

BY B. S. SUMMERS.

While a great deal has been published on the identification of the different fibres in commercial use, much of this has not had a truly commercial aspect. It is frequently difficult to identify a fibre from the description given in commercial text-books, especially where fibres closely resembling each other are examined under a microscope after the ordinary treatment or mount. The separation of the ultimate fibres by teasing is tedious, and often leads to a very unsatisfactory mount. The best way is to remove by chemical treatment the resins cementing the ultimate fibres into the filament. This is more difficult with some fibres than with others, those having a high content of silica being usually the most refractory. In this particular, Sisal and Manila are the most noteworthy.

In a commercial laboratory, where results should be obtained as quickly as possible, a quick temporary mount has to be made which will show the characteristics of the fibre necessary for identification; and in order to prepare the fibre for such a mount, a suitable chemical treatment not occupying too much time is a great desideratum. The best method consists in boiling the fibre in a 2 per cent. solution of caustic alkali, washing and suspending the fibre in water, and passing a stream of chlorine gas through it until it is thoroughly bleached and the gums thoroughly destroyed. This may also be done by placing the specimen in a solution of chlorate of potash acidified by hydrochloric acid. At this stage the filament is entirely destroyed, but the ultimate fibre retains the form of the filament. The material is then rinsed in alcohol, and mounted in Canada balsam in the usual way. After this treatment there should be no difficulty in teasing out the ultimate fibre.

The fibre may then be examined under a microscope and micro-photographed. The best method for the examination of fibres is with artificial light, using a polariser. The joints or markings on the fibre seem to have a different rotatory power, or at least they are brought into a more distinctive effect in relation to the rest of the fibre. This is also true in photographing, and the best photographs have been obtained by using an arc light and polarising the rays. The markings are more distinctly brought out when the analyser and polariser are in such relative positions that the background or field is almost totally dark. Some micro-photographs are here appended, most of which were taken by using polarised light with a dark background. The magnification is about 300 diameters, with an exposure of about 30 seconds. In this work the Carbutt B plate is found to give very good results.

To distinguish between Sisal and Manila is one of the hardest problems of fibre identification, but little trouble has been found after treating the fibres in the manner described above.

In Plate I. will be seen a collection of pure Manila fibre. The large fibre out of focus running transversely across the plate is Sisal.

In Plate II. will be found a mount composed of both Sisal and Manila, the Sisal having a horizontal position, while the Manila is mainly vertical. The Manila is an even tubular fibre, having joints somewhat resembling bamboo; these joints, however, are very indistinct, except when the fibre has been carefully cooked and examined with a moderately high-power lens. The dark centre of the fibre is quite constant in width, although the width varies in different fibres. Plate II. gives a very good idea of the ends of the Manila fibre, where the joints are very near together. The characteristic appearance of Manila is very much enhanced by the chlorine treatment, and the same is true of Sisal. The Sisal is very much coarser than Manila, and tapers considerably more; when properly cooked the dark centre is seldom apparent. It has, however, after the treatment mentioned above, peculiar markings, having transversal cross-markings which appear to form X's upon the fibre. This is very clearly shown in Plate II. in the coarse Sisal fibre, and seems to be constant with this fibre. Manila and its shive do not reveal the same. It is very often difficult to positively identify Sisal in Manila paper, but this method of examination seems to yield quite certain results. When Manila rope which contains Sisal is used in paper-making, the Sisal causes considerable trouble. It does not beat up nearly as well as the Manila, and is often found in Manila paper as long yellowish fibre. It also partially or wholly prevents the perfect felting of the Manila, and causes lines through the paper. Frequently the rupture of the paper along Sisal fibres is as clean as though cut with scissors, and often follows peculiar curved lines. When these fibres are abstracted from Manila paper, cooked and examined by the method above described, it is possible to bring out these peculiar cross-markings.

The peculiar formation of the cotton fibre is so distinctive as to need no comment. Wool with its peculiar scaly appearance, is also very distinctive, and where wool and cotton are found together they are readily distinguished by any ordinary mount. The above treatment has never been tried on animal fibre, for the reason that nothing would be gained. It is to be regretted that no microphotographs of cotton or wool are available for this paper.

Silk is also distinctive; it is quite even, but occasionally little nodules are noticed in the side of the fibre, and for this reason it is not as regular in width as the Manila. It has apparently no markings, and its ultimate fibres are also its filament. In Plate III. will be seen a fine Italian tram silk, taken with polarised light with a one-ninth inch objective.

Among the textile fibres the most difficult to distinguish one from the other are flax and ramie. They are used in the same class of work, when ramie is used at all, and have the same general microscopical appearance. Ramie at first sight looks very like flax, although upon a minute examination a difference will be observed. The ultimate fibre of ramie is usually coarser, the bamboo-like joints are larger and more marked, and have quite a different appearance from that of flax as seen with a moderately high-power glass. They seem to have two distinct marks running around the fibre, with connecting lines, while with the same power-glass the ordinary linen fibre seems to consist of but one mark. The difference is readily discernible in Plates IV. and V., Plate IV. being flax and Plate V. being ramie.

For purposes of comparison, a photograph of a filament of flax magnified about 100 diameters is here shown. The irregularities are due to clots of gum incompletely removed in the retting. (See Plate VI.)

This is a brief attempt to outline rapid and easy methods for the commercial identification of these fibres. It is hoped that others may derive a little help from the writer's experience.

Discussion.

Mr. R. C. **Woodcock** said that many who had to do with food products often found difficulty in making a section so as to view the material, because it had been pulverised. For instance, coffee was very dark, and it was difficult to see its colour. The most satisfactory way was by boiling with soda to remove the resinous and fatty matters and washing, then adding bleaching powder and a little hydrochloric acid, and again washing. This gave a white soft material for microscopical examination, which was readily reduced to a sufficiently thin layer by pressure under the cover glass.

Nottingham Section.

Meeting held at University College, Nottingham, on October 25th, 1899.

PROF. F. STANLEY KIPPING IN THE CHAIR.

FURTHER NOTES ON THE ACTION OF THE DUNG BATE.

BY JOSEPH T. WOOD.

The present notes are a continuation of those published in this Journal, 1898, 1010. It has been impossible for me to follow up the subject except in a desultory manner, but I think it desirable to put further results, however meagre, before you with the object of throwing more light on the complex process of bateing hides and skins.

Since the previous notes were written, Dr. Th. Korner (10 Jahresber. d. Deutsch. Gerberschule zu Freiberg, 1898–99: Beiträge zur Kentniss der wissenschaftlichen Grundlagen der Gerberei, p. 32) has called attention to the physics of the process, a matter which I had not previously mentioned. He explains part of the action by differences of osmotic pressure. The ammonium salts and salts of organic bases contained in the dung possess a smaller osmotic pressure than the solution of calcium hydrate contained in the skins. The ammonium ion endeavours to unite with the hydroxyl ion of the calcium hydrate to form undissociated ammonium hydroxide. In consequence of the osmotic pressure and the electrostatic attraction of the oppositely charged ions, the calcium hydrate solution is withdrawn from the skin and the latter falls.

Experiments with Bacteria on a Large Scale.

I have shown (this Journal, 1898, 1011) that simple cultures of bacteria in certain nutrient media, in the absence of amines and other bodies, have an imperfect bateing action on skin. This was the case, whether the cultures were pure or mixed, but the mixed cultures have a better action than the pure cultures of any of the organisms I have hitherto used. Bacteriological processes in nature are usually carried on by a mixture of species of bacteria; still there are fermentations like the spontaneous souring of milk, the formation of nitrites from nitrates, and the ammoniacal fermentation of urea, which may be considered as natural pure cultures. These are examples of what I may call the selective influence of the nutrient medium. The nutrient medium used in my former experiments was a solution of gelatin and mineral salts, such as is used in general bacteriological work, modified in various ways. On careful consideration this did not appear to be a medium at all corresponding to the natural bate. The albuminoids in the process of digestion are peptonised, and dung contains only those bodies which the animal is incapable of assimilating. It is from these bodies that the necessary enzymes are produced by bacteria. Of the numerous trials with pure cultures of different organisms from dung, I found that most of those having the property of secreting bateing enzymes were non-liquefying bacteria. Popp and Becker have also pointed out that peptonising bacteria do not exert a favourable reducing action on skin. It is impracticable to grow these non-peptonising organisms

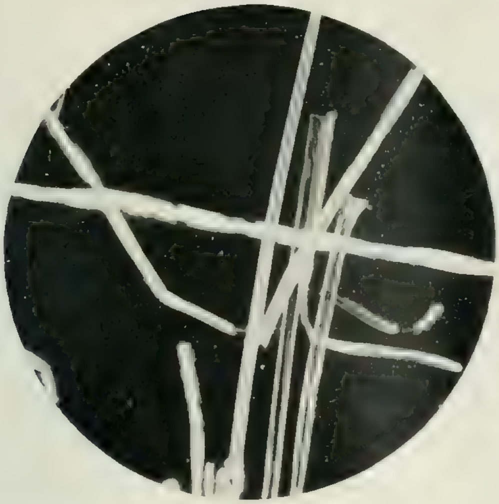


Plate I.
MANILA.

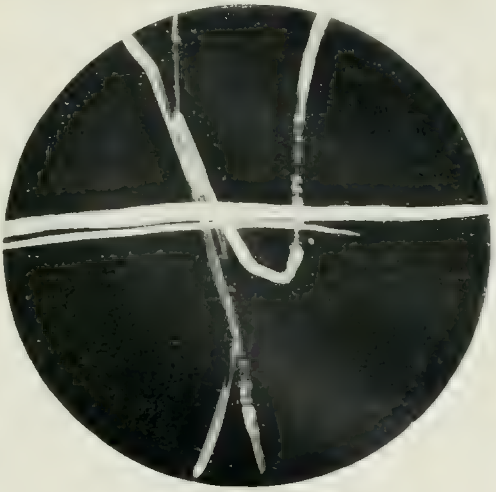


Plate II.
SISAL AND MANILA.

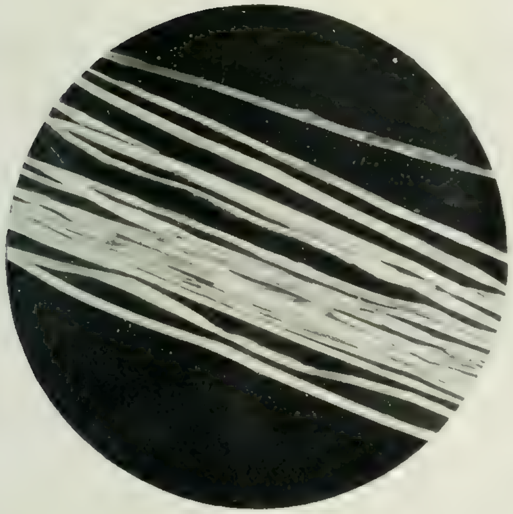


Plate III.
ITALIAN TRAM SILK.

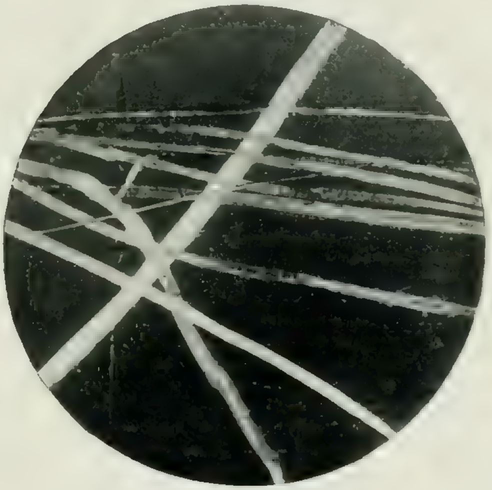


Plate IV.
ULTIMATE FLAX FIBRES FROM IRISH LINEN.

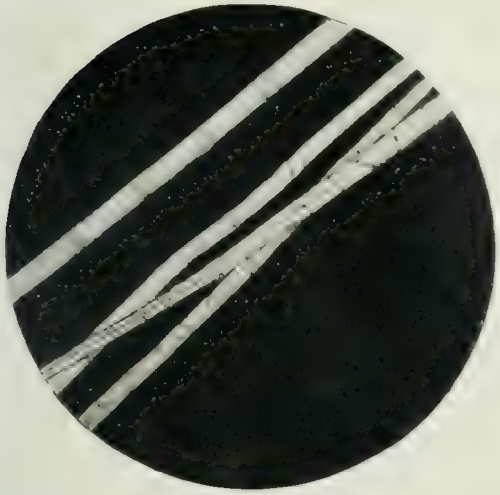


Plate V.
CHINESE RAMIE.

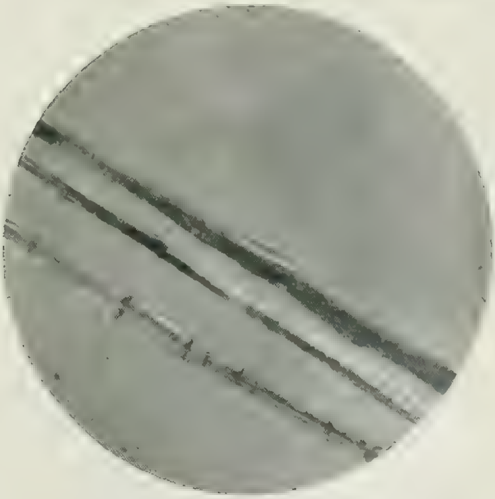


Plate VI.
MICHIGAN FLAX FILAMENT.
(About 100 diameters.)

on a large scale in a solid medium, and it occurred to me that gelatin, previously peptonised by chemical means, would be a favourable medium. Experiments with hydrochloric and sulphuric acids gave hopeful results. The acid was neutralised with ammonia after the chemical action was complete, and the bacteria cultivated in this solution.

A better result was obtained by digesting 10 grms. gelatin, 5 grms. lactic acid (anhydrous by calculation), 100 c.c. water, in a closed vessel on the water bath for three hours. A slight black precipitate of melanoidic acid (humic acid) is formed. The liquid is of a clear brown colour, and contains a large number of nitrogenous bodies resulting from the breaking down of the gelatin molecule. It has been impossible for me to ascertain its exact composition, but I have partially examined it with the following results :—

1. A small quantity of the liquid poured into absolute alcohol gives a white precipitate which re-dissolves on the addition of about 30 per cent. water. This shows absence of gelatin.

2. On saturating with ammonium sulphate a brownish precipitate is thrown down which is perfectly soluble in cold water. It consists of gelatose lactates which are evidently formed in an analogous manner to the gelatose hydrochlorides prepared by C. Paal (Ber. **25**, 1202; also Allen, Comm. Org. Analysis, **4**, 466. E. Marpmann, Centralblatt. f. Bact. **2**, 5, 67). The gelatoses correspond to the protoses formed during the digestion of albumin. In one sample 1·3 grm. gelatose lactates per 100 c.c. was found.

3. The filtrate from (2) was dialysed against running water for 15 hours to get rid of the ammonium sulphate. The resulting gelatin-peptones, or gelatones, amounted to 9·1 grm. per 100 c.c. In other words, the heating under pressure had transformed 87 per cent. of the original gelatin into true peptones.

It may be presumed that the other and simpler nitrogenous bodies formed are the same as those produced by the treatment of gelatin solutions by dilute mineral acids, and that the bases combine with the free lactic acid. An excellent list of these and a very interesting account of the protamines and hexones which go to form the complex albumin molecule is given in a paper by Dr. A. Kossel, Rev. Gen. des Sciences, 1899, p. 380.

The solution of gelatone lactates and free lactic acid prepared as above, was neutralised with sodium carbonate and diluted to 1000 c.c.; it was found to be a very good medium for the growth of the bateing organisms after the addition of a small quantity of potassium phosphate.

In looking round for suitable means of testing the action of both pure and mixed cultures of bacteria on a practical scale, it occurred to me that the Carlsberg vessels, as used by Hansen for the pure cultivation of yeast (Jorgensen, the Micro-organisms of Fermentation, p. 20), would answer for the cultivation of bacteria also. I was unable to obtain any information on the subject, and was surprised to find that the apparatus is very little used in England. I procured two of these vessels from Jensen of Copenhagen, and found they answered very well. The bacteria were transferred from the test tube in which the original inoculation had been made to a Pasteur flask of 250 c.c. capacity containing the nutrient solution; when the growth in this flask was sufficiently vigorous the Carlsberg vessel was inoculated from it in the manner described by Hansen, and with all the usual precautions.

After three days at a temperature of 37° C. the whole of the 10 litres was used for inoculating 100 litres of the nutrient medium above mentioned contained in a clean barrel standing in a room, the temperature of which was maintained at 37° C. By using this comparatively large volume of pure culture for pitching, if I may be allowed to use a familiar brewing term, the large culture was kept practically pure, although it could not be supplied with germ-free air, as in the case of the Carlsberg vessel.

Using a nutrient medium containing 1 per cent. original gelatin, the maximum bateing effect was obtained with the majority of organisms in three days.

In my previous notes I showed (this Journal, 1898, 1012) that a mixture of digestive enzymes and amine hydrochlorates was effective in bateing skin. The liquid in this case was free from bacteria. It was found, however, that the action of the bate was hastened when an active growth of bacteria was going on at the same time in the liquid, even though the quantity of enzyme present was smaller. This is what one might infer from a careful study of the process. It appears better for small quantities of enzymes to be produced in the liquid as required, than to use larger quantities of stale enzymes.

Mr. Loxley Meggitt was kind enough to concentrate for me about 170 litres of a culture of bateing organisms. The concentration was conducted *in vacuo* at a temperature below 50° C., at which the enzymes were certainly not injured, and it was found that when this concentrated culture was diluted to the same strength as the original, that the action was considerably diminished. This diminution of activity was due in part to a loss of volatile products in the evaporation, but more especially to the absence of an active fermentation going on in the liquid.

The nutrient medium above described, besides acting in a selective manner on a mixture of bacteria, and providing them with food stuff, contains amido compounds and other bodies which are eminently favourable to the proteolytic action of the enzymes, and therefore act in the same way as the amine hydrochlorates which I used in former experiments.

The action of the following bacteria grown in this medium has been tried on skin. The pure cultures are lettered in continuation of previous descriptions (this Journal, 1898, 1012).

1. Bacillus *c*, isolated from pigeon dung bate. Small, round, bluish-white colonies, standing up slightly above the surface of the gelatin, but not spreading out on the surface, non-liquefying pairs of micro-bacteria. This was the principal organism found in a pigeon-dung bate as used for the bateing of E. I. kips. Grown in nutrient broth or in the special medium it had no reducing effect on skin.

2. Bacillus pyocyaneus from blue skin, *i.e.*, skin in an early stage of putrefaction. No action.

3. Mixed culture from fresh pigeon dung, collected in a sterile vessel. This contained very few bacteria capable of developing in the special medium. The action on skin was no more than that due to the chemical compounds present.

4. Mixed culture from fresh dog dung. This contained remarkably few species of bacteria which came to a good development in the special medium. The principal organisms were a jointed bacillus with extremely rapid vibrionic movement, and a small bacterium in pairs; the action on skin was perceptible but slight.

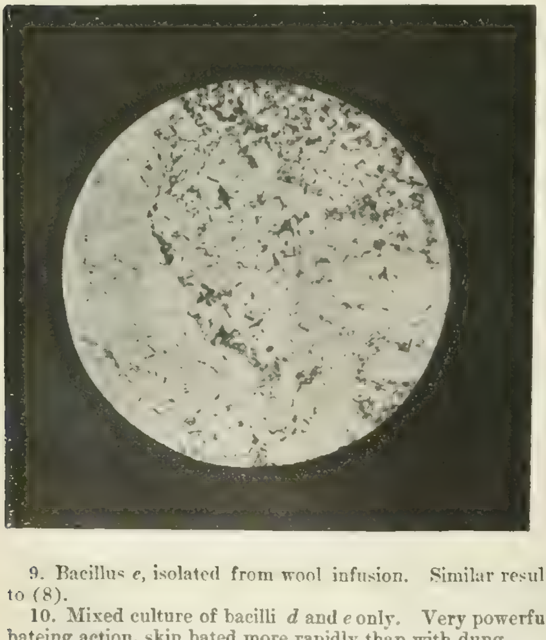
5. Mixed culture from dog dung one month old, as used in the bate. The action of this in a certain medium has already been described (this Journal, 1898, 1012). In the special medium it was distinctly better and almost equal to that of the dung bate.

6. Mixed culture from fresh fæces gave a similar result to (3). A microscopic examination showed pairs of small bacteria and micrococci, but no bacillar forms.

7. Mixed culture from fresh horse dung had a moderate but distinct action on skin, about equal to (4).

8. Bacillus *d*, isolated from wool infusion. Very slight action.

Fig. 1.



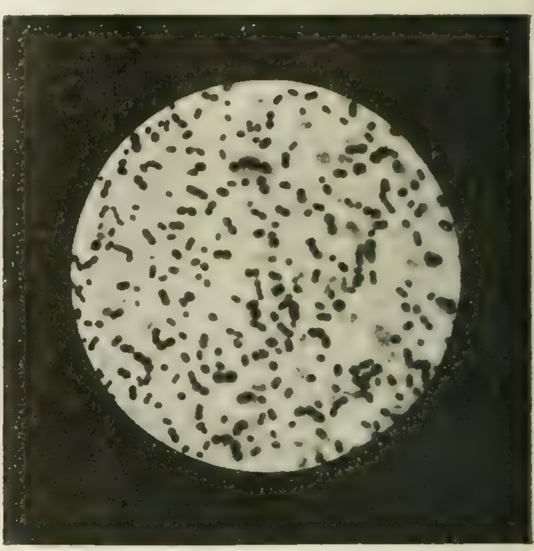
9. Bacillus *e*, isolated from wool infusion. Similar result to (8).

10. Mixed culture of bacilli *d* and *e* only. Very powerful bateing action, skin bated more rapidly than with dung.

These experiments tend to confirm the conclusion (this Journal, 1898, 1012) I previously arrived at, *viz.*, that no single species of bacteria produces the complex chemical and physiological changes which take place in the dung, and which result in the production of the bodies necessary for the proper bateing of skin. It is a well-known fact that dog dung requires keeping for at least a month before it gives the best result. During this time it undergoes a kind of fermentation and continues to improve up to two months, after which it deteriorates. The rate of fermentation depends upon the season.

It is evident from these facts that the bacteria present in the dung when it leaves the animal's body do not produce the required enzymes and chemical compounds, and that these are produced by bacteria which obtain access from the air. It is also evident that the production of these enzymes depends upon the composition of the nutrient medium, since this exerts a selective influence on the species of bacteria obtaining access to it. In the spontaneous souring of milk numerous bacteria in the air have free access to the milk, yet the lactic ferment is generally so pure that it may be and is used as a pure culture on a large scale in the manufacture of lactic acid. Dog dung is a favourable medium for the bacteria secreting the bateing enzymes; but if dextrose or other carbohydrate be added to fresh dung an acid fermentation is set up which effectually prevents the development of the bateing organisms.

Fig. 2.



Reasoning along these lines I was led to try some cultures of air bacteria in my special medium, and I found that a good source of such organisms likely to have a useful effect was a sweating stove as used for the depilation of skins. The hair roots are loosened by bacterial action; the wool, when it slips, brings away with it the epidermis. The root portions of the wool were cut off and digested in water at 35° C., the liquid strained off and used for making plate cultures in the usual way. In making the attenuations for the plate cultures, the fourth was found to be practically a pure culture of the organism I have called bacillus d. or the sweating bacillus. It forms large whitish colonies, spreading on the surface, with irregular contour. The bacilli are very small, mostly in pairs, but sometimes joining together in thread-like forms. (Fig. 1.)

Grown in the special medium it had little or no action on skin. At the same time I found that a culture made from the original liquid, *i.e.*, a mixed culture of the sweating organisms, had an exceedingly powerful bateing action; indeed, the skin was bated more rapidly than with dung.

All the experiments carried out so far tend to prove that mixed cultures of suitable bacteria possessed the required action, whereas pure cultures do not. A further examination of the infusion of wool roots showed that the bacteria contained in it consisted practically of two species only. The first of these I have already described, the second one, bacillus *e.*, forms small brownish-yellow boat-shaped colonies on gelatin plates, very similar to one of the dung bacteria. They consist of plump cells, two or three times the size of bacillus *d.*, united in pairs and short chains and surrounded by a capsule; the cells appear to vary considerably in size. Cultivated in the same way as the others it has very little action on skin. It is evident from these facts that the growth of the bacteria is a symbiotic one; separately they exert little or no action, whereas used together the action is most remarkable.

The author wishes to express his indebtedness to Mr. J. Golding, F.I.C., of University College, Nottingham, who made the first pure cultures of these "wool" bacteria.

The Influence of Solid Matter in the Bate.

In making comparative tests of my artificial bates and dog dung, I usually took the latter from the paddles in which it was diluted ready for use, and maintained both solutions at exactly the same temperature. Parts of the *same* skin were then digested in each solution, and the results noted after 1½ hours. In order to make them more strictly comparable I filtered the dung bate, so as to employ the matter actually in solution when the bate was made up. It was found that the filtered bate had far less action than when it was used in an unfiltered condition. That this is not wholly due to the passing into solution of some of the solid matter during the bateing was shown by adding an inert solid, *viz.* kaolin, to the filtered bate, when the action was greatly hastened. On adding kaolin to the artificial bate and keeping the liquid agitated, the same result was obtained. It seems that the finely-divided solid matter acts as a carrier for the enzymes, perhaps by a kind of mass action, each particle offering a surface vastly greater than the molecules of dissolved solids. In the case of "puer," the organic insoluble matter is gradually brought into solution by bacterial action as the bateing proceeds, though I do not believe this occurs to any great extent.

The following quantities of soluble and insoluble matter were found in puer wheels in actual practice per 1,000 c.c. :—

—	1.	2.	3.	4.
Total solids	10·20	8·63	8·64	3·26
Soluble..................	6·00	4·57	6·19	2·14
Insoluble................	4·20	4·06	2·45	1·12

1. Wheel in constant use for a week.
2. Wheel freshly made up.
3. The same wheel after one lot of skins.
4. From pigeon dung bate pit.

On comparing 2 and 3 it will be seen that apparently 1·61 grm. of the insoluble matter has passed into solution. This is not entirely the case, for part of the additional soluble is lime and hide substance from the skins, while part of the insoluble at the same time adheres to the skins and is not estimated.

In conclusion, it will be seen that it is now quite possible to produce an artificial dung bate, or rather a bate having the essential properties of a dung bate, by producing the required enzymes by fermentation and then adding to them the amine compounds. Such a bate I am able to show you here. The chief difficulty in its practical application in the tannery is the question of cost. If this can be overcome, and efforts are being made to overcome it, there is no doubt that the tanners of the next generation will be supplied with a bate which will do the same work as the dung bate, and which will have a definite and uniform composition and properties, and a regular and certain action. The tannery will become cleaner and healthier, and what is perhaps of equal importance, the sewage effluents will be comparatively harmless.

Discussion.

Prof. F. Stanley Kipping said he was sure that all those who had heard Mr. Wood's highly interesting communication would join in congratulating him on the new results which he had obtained, but as the chemistry of tanning was a subject of very great complexity, only those who had made it a special study would be able to appreciate Mr. Wood's work at its true value. As far as he (the speaker) could judge, Mr. Wood had made a very important step in advance, and had succeeded in preparing what might be called an "artificial bate." He had done this by first endeavouring to ascertain the mode of action of the ordinary dung bate, and then producing by fermentation a similar series of actions. From the fact that two organisms were employed, it seemed possible that two distinct fermentation processes were involved, as for instance in the ordinary conversion of starch into alcohol; perhaps the author would give his views on this point in his reply.

Mr. L. Archbutt, F.I.C., said that the action of the kaolin as described appeared to be a remarkable one.

Mr. S. J. Pentecost asked if skins bated as quickly in bird dung infusions as in dog dung, the difference in total solids in the two bates being very considerable.

Mr. J. Golding thought that Mr. Wood had well shown the important part played by the nutrient medium employed, and that in experiments of this kind the conditions of growth were of the utmost importance.

Mr. J. T. Wood, in reply, said he did not consider the fermentation at all comparable to the conversion of starch into alcohol by means of two separate fermentation processes. The two organisms he had described were mutually advantageous to one another, and their action appeared to be due to a true symbiosis. In reply to Mr. Pentecost, the bird dung bate took a longer time to act than the dog dung, the reason being, as far as he knew, that this bate was employed at the temperature of the air, whereas dog dung was used at 37° C. There was also a somewhat different chemical action (see this Journal, 1894, 219) caused by the fact that bird dung contained all the urinary products which were not present in dog dung. He had endeavoured to show the important part played by the nutrient medium in the production of the required enzymes. If one used the right bacteria in a medium in which they would grow well, plenty of enzymes were produced; but in nutrient media in which a certain constituent was missing little or no enzymes were produced. He was ignorant of the true part played by the solid matter in the bate further than he had explained in the paper; nevertheless it was an undoubted fact. He would like to have the opinion of some of our brewing chemists on this point.

Scottish Section.

Meeting held at Edinburgh on Wednesday,
October 11th, 1899.

MR. G. T. BEILBY IN THE CHAIR.

A PAPER MAKER'S RESEARCH LABORATORY.

BY CHARLES F. CROSS.

What is the actual attitude of paper makers as a body to science? This is not a question of a pious opinion as to the advantage of "technical education" of paper-mill workers: nor is the answer, which is not difficult to find, qualified by the fact, that paper-makers as individual members of a XIXth century society, are just as much imbued generally with the scientific spirit, and as keenly alive to the necessarily increasing power of science, as any other section of the industrial community. No paper maker will question the answer that the attitude of the industry considered as a whole, is that of prejudice: not a pre-judgment in favour of, but against the scientific tradition, as applied to the production of paper. The prejudice rests upon the following propositions, which are self-evident to the so-called practical intelligence :—

(1.) Paper mills are run not to make paper but to make money.

(2.) Paper having been made for some centuries without the aid of science, in the specialised sense of the term, the art will continue to flourish on its purely empirical basis.

(3.) On the hypothesis that science may contribute to the perfection, or re-perfection of the art, there is no inducement to the paper-maker to improve his papers, because he cannot secure improved prices.

Now it is of little avail to oppose to this, the *a priori* care or pre-judgment *in favour of* science, which rests upon the following propositions :—

(1.) Science spells light, whereas empiricism spells darkness and fog.

(2.) *The actual operations involved in the paper-making processes are not those which are visible in the mass, but the invisible,* to be followed only by the scientific imaginations, aided by those instruments and observations which belong to the science of physics and chemistry.

(3.) The industry resting essentially upon scientific foundations offers a wide, if not inexhaustible, field for the activity of the science students of this and future generations.

Between these extremes of prejudice probably lies the middle course of positive advance. No practical result will follow from labouring general arguments; it must be our present aim to arrive at definite issues. We may emphasise this necessity for something like a heroic effort by pointing out that the general argument has been before the technical public of this country for *two centuries.*

The great Robert Boyle postulated the scientific foundation of all our productive industries, in terms which are as fresh and to the point at this date as when written. The following passage is reproduced in illustration from "The Philosophical Works of Robert Boyle," edited by Peter Shaw. London, 1725.

In an essay "Showing the Advantages of Natural Philosophy to Human Life," we read:—Pages 105—117. "It appears highly probable that good naturalists may greatly reform trade or improve it, since in general it depends only upon a small number of particular productions of nature, and largely lies in the hands of the illiterate. . . . . An attentive consideration of the parts that constitute each particular trade would show how they all depend upon philosophy, and might thereby be further improved . . . and the more comprehensive any trade is the more improvement it will admit of from philosophy. Further, a naturalist may likewise introduce new trades as well as improve the old ones, and that either by inventing them originally or bringing them into request where they were unknown before; for neither nature nor human invention is so far exhausted as not to afford them were philosophy employed in the search. We may here observe that a trade in many cases differs from an experiment, not so much in the nature of the thing, as its having been accidentally applied to human uses or made a business by a company of artificers in order to their own profit, which are things extrinsical and accidental to the experiment itself.

That "paper" was a subject to which Boyle devoted his special attention, appears from the following noteworthy passage:—

Paper besides its common uses may be made into frames for pictures, fine embossed work and curious movables, by steeping a convenient quantity of the best white sort for two or three days in water, till it becomes very soft; then reducing it by the mortar and hot water into a thin pulp, to be laid in a sieve to drain off its superfluous moisture; afterwards putting it into some warm water, wherein a considerable quantity of fish glue or common size has been dissolved; for being now with a sponge pressed into moulds to acquire the figure designed it may when taken out be strengthened as occasion requires with plaster or moistened chalk and when leisurely dried, painted, or overlaid. . . . Another uncommon use of paper is to stop up cracks or fissures in wooden vessels to hold water, for in this case it will forcibly dilate and fill the place wherein it is lodged.

"For" adds the philosopher, "*the qualities of materials generally depending upon the texture of the small parts whereof they consist,* the ways of ordering them whether by an addition, detraction, or transportation of their component corpuscles so as to produce any remarkable change in this texture, bid fair to introduce new properties and uses."

In view of these remarkable records we must admit that we have progressed very little towards a general realisation of this forecast in actual practice.

It is possible that an enlargement of the technical horizon of the paper maker might come from the æsthetic as well as the scientific side. The operations of a paper mill are profoundly interesting, not to say fascinating; and yet in this country, which has produced the "gentleman farmer," we never heard of a "gentleman paper maker!" The notion of running a paper mill for the pure pleasure of the thing would no doubt strike "the trade" as distinctly comic. "Turn into a Lancashire paper mill (doing its 120 tons a week) on a drizzling November afternoon, and then talk to the foreman of the æsthetic interests of his craft!" This is the kind of criticism which is consistent with the view that a paper mill is after all merely a profit-grinding affair. It might perhaps contribute to a more elevated view of the industry to construct and run a model mill, not only ideal as to its technical plan, but with a setting of elegant surroundings, consistent with the elegance of the processes involved. It is only right to make mention of this side of the subject in an endeavour to view it comprehensively. But as it hardly comes within the practical limits which we have set ourselves to observe, we proceed to our immediate subject, which resolves itself into a sketch of the actual working function of the scientific man in the prosaic paper mill.

We will first state the case negatively. In what respect does the average paper mill rest upon unscientific foundations or traditions? (1.) That it is without adequate provision for exact experiments, for investigations, not merely necessary in the routine of production, but for the introduction of such new processes and products as are called for in the evolution of industry and trade.

(2.) As a consequence, the mill possesses no technical records—no records in terms of quantities and numerical measurements of qualities, no results of the analytical study of the essential factors of the paper-making processes.

(3.) These processes and the products are not quantitatively accounted for other than in the commercial books of the concern.

Let us trace some of the consequences of these defects. No mill can avoid making experiments; and, indeed, every progressive paper-maker knows that the growth of his affairs must be continually provided for by experiments. Any experiment involving the paper-making process itself, involves therefore the disturbance of the routine of the whole mill, or an entire section. This is not only an economic blunder, but imposes the most unfavourable conditions possible for an experiment, and also for the judgment as to the results of the experiments. If the appeal lay to complete technical records, the decision would take the form of a comparison of figures, it would be impersonal and objective. As it is, prejudice, for or against, may—indeed, must—play a determining part, and, to use the words of Shakspear, "Enterprises of great pith and moment are sicklied o'er with the pale cast of argument." But apart from the question of experimental enterprise, how is the routine of the mill to be adequately controlled without continual close scientific observation? Of course, in half-stuff mills, the processes involved in the conversion of the raw materials into half-stuff being essentially chemical, are usually controlled, to a certain extent, by the routine observations of the chemist. But the chemist is seldom appealed to by the beater-man or machine foreman. The process of beating is controlled by the "poker test," followed by the "bowl test;" then the stuff is sent forward on its last journey, and on the machine it is judged by the "tongue test," general appearance, and handle, with perhaps an occasional observation of the appearance of the stuff on the wire. To those of us who handle the sheet of paper with the admiration—not to say, affection—begotten of the sense of the profound structural secrets contained in its substance, and who naturally idealise the industrial art which provides us with this still mysterious conglomerate, the contemplation of the "hugger-mugger" (excuse the word) conditions of the average mill is particularly depressing.

The remedy for this appears to lie in the institution of an experimental and research laboratory in connection with every mill, not merely "a place" for the testing of "stuffs" and papers, but an intelligence department presiding over the entire technical routine. In giving a rough sketch of the work of such a laboratory we do not intend to argue doubtful points; we shall make certain assumptions to complete a position which it is necessary for those to take up who wish to break with the tradition of empiricism once for all.

As the "centre of gravity" of our system of practical research we install the ancient hand-mould. With this instrument paper can be made with such precision and uniformity as to exclude any more serious variations than those which fall within an ordinary limit of experimental error. The numerical constants involved are as we know: weight per unit of area; thickness; breaking strains and elasticity in the two directions at right angles. Assume that from a vat of well prepared material the operator can produce a succession of sheets, which, when measured in regard to these details of structural qualities, give numbers agreeing within a certain limit, say, 5 per cent. This supplies the experimental basis of systematic investigation. In any given mill the results require next to be carefully compared with those obtained on the machine. That is, the prepared stuff is taken from the beater or chest supplying the machine, and converted into hand-made sheets, which are carefully finished, and tested comparatively with the machine-made paper. In this way there is established a definite basis of comparison of the laboratory and mill results, in terms of paper itself.

We now proceed to apply these results to the critical investigation of the beating work of the mill. We begin with the experiment. A sample of the stuff is drawn, at any moment, and submitted to what the chemist knows as a process of fractionation. It is evenly diffused in a large volume of water, and allowed to settle. Means are provided for drawing off the settled or partially settled stuff in three "gravity" fractions. These fractions are then examined; the relative weights (in the pressed condition) are determined, they are examined microscopically to determine extreme and mean lengths of fibres, and the fractions are then made into sheets on the mould. The finished sheets are tested for breaking lengths and elasticity.

By such observations we first determine the optimum condition of the beaten stuff in regard to any required characteristic in the finished paper. Next, what proportion of the stuff is brought into that condition in the operation of beating of the mass; whether that optimum in one direction requires to be sacrificed in another, and to what extent, in order to secure the working average. We compare one beater with another, and one half stuff with another, we can also compare the papers of various mills by taking them to pieces and examining the stuff in the *status in quo ante.*

The theoretical basis of this method is the analytical study of the various factors of the paper-making process. These are: (1) the fibres are deposited from suspension in water; (2) the fibres vary in substance, length, and form; (3) the cellulose of the fibres is more or less "hydrated." The structural factors are of course largely determined by the heating process, which also undoubtedly affects the third factor; in fact, it is well known by the extreme effects, *i.e.*, of prolonged beating, that the cellulose may be brought into a gelatinous or colloid form bordering on that of actual solution.

Supposing now we present for solution a theoretical problem. Reverting to the fractionation process above considered, we may define our "gravity" fractions as *isobaric* when they deposit from suspension in water in *equal times* all conditions being kept uniform.

What conditions of heating are required to reduce to isobaric conditions, half stuffs from wood (cellulose), esparto, cotton, and linen? In the isobaric condition, what will be the relative (average) lengths of the fibres? What is the relative influence upon the isobaric condition of the two main factors, *viz.*, length and degree of hydration of the cellulose? Lastly, what will be the relative characteristics of the papers made from the materials thus prepared, so far as they can be expressed in the numerical terms of physical constants?

The solution of this fundamental problem in its various phases would require, say, one year's work on the part of an industrious observer. The fruit of that work would be not merely the results themselves, but an experience equal to say 20 years of observation of the facts in the gross, *i.e.*, in the mill.

This problem is obviously followed by those involving subsidiary or adjective effects, *viz.*, loading, sizing, and colouring.

All of these effects, apparently simple, are actually complex. The scientific observer will study them accordingly, that is having subjected the results to dissection or analysis, he will make an experimental analytical study of the factors.

Thus in the question of *loading*, are involved the auxiliary question of the influence of the addition of non-fibrous material (1) upon the more important physical constants of the paper, *viz.*, weight per unit of area, strength and elasticity, and (2) upon the texture and opacity of the paper. There will be an *optimum* to be determined for each effect, as well as the conditions for ensuring that optimum.

In the operation of *sizing*, it is too often overlooked that the condition of the fibrous basis or cellulose itself is an important determining cause of the aggregrate sizing effect of the ordinary rosin-sizing process (engine sizing). (See J. Soc. Arts, Cantor Lectures, 1898.)

The efficiency of the sizing requires careful study in relation to the condition of hydration of the cellulose, and to determine whether the optimum condition is more economically produced by long beating, or by the addition of hydrated cellulose to the stuff in the beater.

The various processes of *colouring* or *tinting*—in the engine—of course admit of very precise control by means of hand-made sheets. The methods ordinarily practised are in fact a crude approximation to as well as a general recognition of the value of the system which we advocate, when carried out under conditions of refinement and precision.

It is not proposed to elaborate this scheme into actual working details, nor to attempt to commend it by adding any inducements based upon a forecast of commercial results likely to follow from its adoption. The suggestion is propounded in general terms, and at a juncture which seems to be opportune from the fact that the representative trade association is seriously attacking the question of promoting technical education amongst its craftsmen. Our own view is that every mill should be self-contained in this respect, and would be if there were scientific order and method in its routine.

Discussion.

Mr. R. C. Menzies said that he was not in the happy position of a gentleman who ran his mill for pleasure, and thought that Mr. Cross would have difficulty in finding such an individual. He would like Mr. Cross, however, to believe that there were, among paper makers, men who at times conducted scientific experiments, and who were somewhat above the condition of empiricism of which Mr. Cross had accused them. In his own mill he had machinery which, after 18 years, still bore traces of experiments, and he could only say that if a mill were delivered over to the ordinary scientific man, the creditors would, at the end of a few years, receive payment of a very small composition in the pound. The paper makers were practical men engaged amid fierce competition in a practical industry, to which they were applying the very best brains, and he ventured to think that they knew something of the subject with which they were dealing. He agreed with Mr. Cross that paper-making, or any other industry which was a living industry, could not be conducted without due regard to its experimental side, but if the experimental were allowed to override the business side by converting the mill into an experimental laboratory, they would soon have no paper mill in which to conduct experiments. He had himself received a scientific education, and had been endeavouring for the last 30 years, day by day, to apply his scientific knowledge to the manufacture of paper. The paper makers were constantly making experiments, but these were carried out in such a way that the ordinary manufacture was not interfered with, and no other policy could be pursued for any length of time. They had to help to supply the "Harmsworth" at 3½*d.*, "Pearsons" at 3*d.*, the "Daily Telegraph" at 1*d.*, and the "Daily Mail" at ½*d.*, and they endeavoured to supply the very best article possible at the lowest price. At the same time he would be glad to hear Mr. Cross' experimental laboratory elaborated.

Mr. W. L. Tod said, that the paper-making industry would doubtless be greatly benefited by a cultivation of its more scientific side, but there were some difficulties as

Mr. Menzies had stated, in combining scientific experiments with the hard work and constant worry involved in running a paper mill, so as to make any profit at all at the present time. Many pretty processes failed when put to the test of practical work, or proved too expensive to be of value commercially. Much good might result from laboratory experiments, conducted preferably by some one with a knowledge of paper making. When the primary difficulties had been overcome by the scientific man in the laboratory, paper makers might take up the process, and determine whether it could be carried out successfully and profitably in practice.

Dr. J. B. **Readman** said, he had hoped to obtain some information regarding the equipment of a paper-maker's research laboratory, and expressed the hope that Mr. Cross would supply this at some future meeting of the Society. He thought that Mr. Cross had dealt rather severely with the paper makers, as he (Dr. Readman), was acquainted with many manufacturers, who were very greatly interested in the scientific side of their industry.

Mr. **Falconer King** said, that he had frequently heard remarks, similar to those of Mr. Menzies, made with regard to other industries, and expressed regret that anyone should take up the position of discarding scientific means of improving the manufacture of paper or any other article, on account of the necessity of producing that article at a certain price, so as to make a profit.

Mr. **Robt. Irvine** said, that Mr. Menzies' remarks were somewhat severe, and might tend to quench the spirit of enterprise among chemists. He had every respect for practical work, but he thought that there was a medium to be found between the views expressed by Mr. Cross and the rather severe strictures of Mr. Menzies.

The **Chairman** said that Mr. Cross appeared to have made out a very strong case for the establishment of a control laboratory in the paper mill. In any attempts to establish scientific control over manufacturing operations, it was of the utmost importance that the system adopted should not in any way interfere with the regular and economical conduct of the manufacture. Mr. Cross had shown on general principles that it was quite possible to establish an efficient scientific control without any interference with the working routine. That being the case, it was natural that the paper makers should ask for such further information as to the details of such an experimental department as would enable him to judge whether in his particular business the prospective advantages would justify the expenditure on the new department. If Mr. Cross could see his way to supplement his paper by a concrete example of the application of a control laboratory, placing the expenditure involved in keeping it up against the savings to be effected by its means, he felt that the idea would then appeal more directly to the paper maker. If the cost of keeping up the control laboratory amounted to 200*l*. to 300*l*. a year, while the possibility of improved and more regular and economical manufacture showed direct or indirect gains considerably in excess of that amount, the paper maker would be justified in feeling his way to the gradual development of the system. They were greatly indebted to Mr. Cross for so kindly responding to their invitation to address them at this special meeting.

Mr. **Cross** said he had not known Mr. Menzies for many years without being aware that he was a master of the caustic art. He was sorry he had used it on this occasion to place him (Mr. Cross) in the false position which he had endeavoured to avoid in his opening remarks. He was the last in the world to presume to come to a paper-making centre and lecture the paper makers on their business; but he claimed the right to idealise the paper-making art and to insist on its essentially scientific foundation. He had more expressly endeavoured to show that science in the paper mill had the direct and practical functions (1) to reduce the cost of experiments—always and admittedly necessary—from pounds to shillings; (2) to lay bare the actual factors of the paper-making process, by means of the microscope and balance, with which and other scientific instruments, and to those trained to use them, they alone are visible. These were facts of the simplest order, and therefore, it appeared, difficult to see. It would be gratuitous to insist further that the paper makers as individuals were as advanced and distinguished in regard to science as other sections of the community; nevertheless as a body and in regard to their industry entirely prejudiced against science. He was there to say it and to maintain it.

PROBLEMS IN PAPER MAKING.

BY J. G. FLOWERDEW LOWSON.

1. Can the effect which is apparently produced by boiling esparto grass when the water contains a certain quantity of salt be got over?

With hard water containing about 80 grains of salt to the gallon, about 20 lb. of 70 per cent. caustic to the cwt. of grass are found to be necessary, and the grass throughout remains "Blay" and dead in colour, and never bleaches to a sparkling white. Can this be remedied?

2. Why is it that when perfectly white and new linen or cotton rags are boiled with caustic soda, they come out of the boiler stained and brown? Is this caused by a decomposition and consequent loss of fibre, or how does it arise?

The nature of the problems involved in the above questions and the conditions by which they are surrounded are as follows:—

Esparto grass is used to a large extent in Great Britain as the raw material from which paper is made. The principal countries from which the supply of esparto grass is drawn are Spain and the north coast of Africa, and the grass varies to some extent in chemical composition according to its source of origin. Cross and Bevan give the following as typical analysis:—

——	Spanish Grass.	African Grass.
Cellulose	48·25	45·80
Fat and wax	2·07	2·62
Aqueous extract	10·19	9·81
Pectous substances	26·39	29·30
Water	9·38	8·86
Ash	3·72	3·67

The cellulose of the grass must be first isolated in order to utilise it for the making of paper. It can then be bleached to the degree of whiteness required, and thereafter be mechanically treated (what is technically termed "beaten") till it is sufficiently drawn out and soft for felting into a continuous web in the paper machine.

The cellulose tissue of esparto grass appears to be of a compound character, *i.e.*, it appears to be cellulose combined or mixed with substances of lower carbon percentage than itself. In addition to this there is, as shown above, a certain proportion of fatty and resinous bodies, while the ash to a large extent consists of silica.

The isolation of the cellulose of esparto grass is in practice brought about by boiling with caustic soda solution; the fatty and resinous bodies are converted into soluble soaps, the silica of the grass is partially dissolved as silicate of soda, and the compound cellulose is presumably split up into cellulose on the one hand, and a series of soluble derivatives on the other. This resolution can be effected comparatively easily. It is not necessary that it should take place under any great pressure; it was carried out at first in open boilers, using a sufficiently strong solution of caustic soda. Subsequently it was found that a saving, both in time and in the quantity of caustic soda required, could be made by boiling under pressure. The form of boiler then employed was the ordinary "vomiting" boiler, containing a perforated false bottom through which the liquor drains, and is forced up again by the steam through a vertical pipe against a bonnet, causing the liquor to spread itself again over the grass, thereby keeping up a constant circulation. The pressure employed was originally about 5 lb. per sq. in.; latterly it has been much increased, and is now not infrequently 50 lb. per sq. in.

In my experience with all ordinary vomiting boilers, it is found advisable to leave a small blow-off of about ½-in. pipe to the air. If this be closed, the grass does not appear to be so well boiled; it has a somewhat dull and dirty look, and has a sickly smell like senna tea. The ordinary remedy with many mill foremen for bad results at the grass boilers is to "increase the blow-off." Of course the higher the pressure employed, the greater is the tendency to waste of steam by such blowing off while boiling. In recent years, it has, however, been found practicable to do without any blow-off, and at the same time still further reduce the consumption of caustic soda by discarding the old vomit and employing instead powerful pumps to suck the liquor from below the false bottom of the boiler, and discharge it again in a shower on the top of the grass, thus causing a rapid and thorough circulation. The grass so treated does not appear to suffer from the defects indicated above. The ordinary quantity of caustic soda required in most paper mills with ordinary vomiting grass boilers is about 16 lb. of 70 per cent. caustic per cwt. of grass boiled, and the time taken in boiling varies roughly from four to five hours according to the steam pressure used.

If, however, the caustic solution be made up with slightly salt water in place of fresh water, equally satisfactory results appear unattainable; not only is a larger quantity of soda required to boil the grass soft, but the colour remains duller and the paper made from such grass is wanting in general brightness and purity of colour. In water showing the following analysis :—

	Grains per Gallon.
Total solid residue dried at 212° F.	136·50
Of which is volatile at red heat	21·00
Saline residue	115·50
Containing lime	12·35
Magnesia	12·23
Soda	33·13
Sulphuric acid	10·33
Chlorine (= 82,88 qrs. NaCl)...........	50·29
Nitrates............................	Traces
Total hardness, in terms of carbonate of lime	49·59
Consisting of temporary hardness	22·32
And permanent hardness........	27·27

The probable combination of bases with acids being as follows :—

Carbonate of lime	18·55
Carbonate of magnesia	3·17
Sulphate of lime......................	4·78
Sulphate of magnesia....	11·28
Chloride of magnesium	16·52
Chloride of sodium	62·52

It is found in practice that with a pressure of 35 lb. to 40 lb. of steam at least 20 lb. of 70 per cent. caustic soda are required per cwt. of grass, and that without removing the defect of the dull character indicated above. Of course the hardness of the water accounts to some extent for the increased quantity of soda, but the question now asked is whether it is possible with water containing 80 or 100 grains of salt to the gallon to produce equally good results as with fresh water, and, if so, under what conditions; if, on the other hand, it is not possible to produce a similar result, what is the exact reason for the difficulty?

It occurs to me to remind the members of the Society that the question of the possible treatment of the esparto ley after boiling is a very interesting one. A good deal of private research took place at one time, but I am not aware that any results were ever published. The ley after boiling is said to contain a considerable quantity of tannin, and it of course contains also most of the soda used. This ley is the main source of pollution from paper mills. It is very dark in colour, and froths readily to an excessive extent, owing to the resinous soaps dissolved in it. The present procedure is to evaporate it down to a thick treacly consistence, and then to run it on to a hot hearth, where the resinous constituents ignite, and the whole burns to a black ash of carbonate of soda, from which the caustic soda can be recovered in the usual way by lixiviation and the addition of caustic lime. If some method could be devised for separating out the tannin and recovering it as well as the caustic soda, it would be interesting scientifically, and might be found to be commercially remunerative.

For the finer and stronger qualities of paper, cotton and linen fibres are used instead of the fibre of esparto grass. The source of economical supply of these fibres is found in rags. As, however, the raw material of these rags has already undergone treatment by the textile manufacturer, the further chemical treatment required at the hands of the paper maker is comparatively slight, and is mainly directed to the removal of foreign matter, such as grease, dirt, and colouring matter. The process usually employed is similar to that already described for esparto grass, the differences being mainly due to the fact that so much less drastic treatment is required for rags. As a consequence, the quantity of soda used and the pressure employed are both much less, while the actual time of treatment is usually prolonged so as to make the chemical action as gentle as possible. In spite of this, considerable loss of fibre ensues from the boiling operation. With cotton rags, the loss of fibre through boiling may be anything from about 10 per cent. to 20 or 25 per cent., according to the state of the rag itself and the severity of the treatment required. *What is the chemical reaction which takes place to cause this loss, and can anything be done to reduce it?* and, similarly, when perfectly white cotton rags come out stained and brown after boiling, what is the explanation? *The brown stain* washes off entirely in the subsequent treatment, but *how does it arise in the first instance, and does it indicate loss of fibre?* if so, can such loss be prevented?

Discussion.

Mr. **Cross** said that these problems had been put before them as a very interesting selection of matters familiar to the scientific practical man. One was inclined to regard the isolation of a pure cellulose from esparto as a simple, instead of a complex problem. The question was exactly similar to that of flax bleaching, and the special difficulty alluded to in the paper was due to the cuticular constituents of the tissue. He would suggest that Mr. Lowson should do something heroic, and treat the esparto first with lime. These cuticular tissues were exceedingly difficult to hydrolyse, and lime was well known to be specially active in this direction. With regard to the question of rags, everyone knew that "cotton" represented a complex mixture. Thus it contained a lot of air as a constituent to be reckoned with, and most people forgot that it was difficult to penetrate cotton with solutions, especially when twisted into yarn. Long before it was penetrated by the alkaline lye it might be raised to the temperature of the boiler, which would cause discoloration. If starch were present these effects would be more pronounced. The cellulose was doubtless exposed to wrong conditions of attack. Assuming starch to be present, he would suggest that the rags should first be melted at 50°—60° C. to get rid of the starch, and then subjected to the boiling process, especially ensuring thorough penetration of the stuff by the active solution before it could attain a high temperature.

HIGHLY GLAZED SURFACE PAPERS.

BY ROBERT IRVINE.

As the chief purpose of paper as a recording material is to be written or printed upon, the writer and printer has a special interest in its quality and suitability for this important object.

All records of events should be as imperishable as possible, seeing these are the means by which such events are handed down to future generations. Our requirements in these days consist of a variety of uses :—

Newspapers as distributors of news, which is only of importance for the hour, and paper and ink for this purpose need only be of an ephemeral quality.

For more lasting uses, such as books, pamphlets, engravings, &c., better materials must be employed, more especially since printing from process blocks, photochromic, or three-colour printing has become the fashion.

Twenty years ago, or less, the wood engraver or the metal etcher gave the printer printing blocks on which the subject of the picture was in bold relief, and which gave a good impression upon any ordinary variety of paper. The adaptation or use of process printing blocks, now so universal, has practically driven wood and metal engraving out of the field.

It was, therefore, necessary to obtain both paper and printing ink adapted to the changed circumstances. Many filling agents, such as pearl white, clay, phosphate of lime, &c., were incorporated with the pulp, but to no real good purpose. The result was that paper for this class of work had to be surfaced or coated with a layer of a substance which would, after calendering, take on and give to the paper so coated a highly glazed and smooth surface, capable of taking ink from the most minute lines or stipple.

As far as I remember, the Americans gave the lead to this high-class printing, and for a long time Harpers', the Century, and Cassiers' magazines were the admiration and envy of English printers; it is to be observed that even now it is only the illustrations which are printed upon a specially prepared paper, the letterpress being printed from paper of the ordinary quality.

The one reason for the use of this highly glazed and surfaced paper is that in process blocks prepared from photographs the relief and depressed portions of these blocks are so very slight that with ordinary paper and with ordinary ink the resulting printing, in place of being extremely beautiful, would be practically a blotch. With such a paper, and given printing ink of the highest quality, wonderfully beautiful impressions are obtained on the surfaced paper, combining fineness of tone with clearness of impression—impossible when ordinary paper is used. The advantage to printers is great in so far as the work is not only as quickly accomplished as on ordinary paper, but from the nature of the glazed surface paper the ink dries more quickly, and, at the same time, the glossy surface seems to shine up through the ink and impart its glossy texture to the printing.

I need say no more as to the difference in value between printing on the old kind of paper and the other; but there are disadvantages in its use.

In the first place, the printed impressions are made upon the surfacing material, and *not upon the paper at all*. With highly coated papers it is quite possible to entirely remove the printed impression by washing the coating of the paper with a little water and rubbing.

Of course this objection is met with the sensible argument that it is not in accordance with the usual condition of things that a book should be wetted.

The second disadvantage I would point out is the excessive weight of books printed on this class of paper, as the addition of so much mineral matter as is contained in the surfacing material makes the paper weigh much more than that of equal thickness of unprepared paper. The third possible disadvantage may arise to paper of this class if exposed to damp and heat, in which case the gelatin which holds the mineral matter together would probably decompose, and give rise to products which would have an unpleasant smell.

These disadvantages appear to me to apply to coated papers even of the highest quality, but they are accentuated (especially the latter point) when the coating material is either sour or in a decomposing condition.

But it is chiefly to the printing-ink maker that the trouble comes from the use of these coated papers, for he has to meet an altogether exceptional condition of matters. In place of his ink drying quickly, owing to the partial absorption of the varnish into the paper, he has now to supply an ink which must dry like paint on a wall, and has to contend with the difficulties of "set-off," as well as to produce an ink so dense in colour that about one-third of it will give the same results as regards colour, as ink of the old class or type.

In concluding these remarks, the question of the permanency of the printed surfaces is the one great point of importance to be considered, and I cannot help thinking that there is something dangerous in using a paper from which, with a little water and rubbing, the whole surface can be removed, carrying with it the printing or engraving impressed upon it. This disadvantage becomes an actual advantage when cheques are printed on such papers, as any tampering by means of chemicals to remove writing simply destroys the cheque and checkmates the forger's attempts.

By passing the coated sheets while moist through a bath containing formalin, the gelatin is rendered insoluble in water and much less easily removable, and thus the tendency to destruction of the printed matter is to a certain extent, removed.

Discussion.

Mr. William Jardine asked whether an enamelling paper coated with the ordinary composition of blanc fixe and satin white, and sized or fixed by a solution of casein (commonly called albuminoid glue), and rendered waterproof by the addition of formaldehyde, was in every way as suitable for printing purposes as a coated paper sized with ordinary animal glue.

Mr. Irvine replied that he had no knowledge of such papers.

Yorkshire Section.

Meeting held at Leeds, on Monday, October 30th, 1899.

MR. THOMAS FAIRLEY IN THE CHAIR.

THE WATER-SOFTENING (OR SO-CALLED "SCOURING") POWER OF SOAPS.

BY F. W. RICHARDSON, F.I.C., AND ADOLF JAFFE.

Over 20 years ago one of us found the so-called "Scouring Power" factor in use in the laboratory of the late Mr. F. M. Rimmington, then borough analyst for Bradford. Whence Mr. Rimmington obtained the process we have not been able to ascertain; but it would seem to have been suggested to the mind of someone acquainted with Clark's soap test for determining the hardness of waters.

Clark's hardness solution is made to contain calcium chloride equal to 16 grains of calcium carbonate per gallon. We make a solution 10 times this strength by dissolving 2·287 grms. of pure calcium carbonate in as little dilute hydrochloric acid as may be necessary; after removing the carbonic acid by boiling, weak ammonia is added to neutralisation, and the liquid is made to 1 litre with distilled water. 10 c.c. of this solution and 90 c.c. of distilled water are put into a white glass half-pint bottle and a 1 per cent. solution of the soap is added little by little until, after vigorous shaking, a foam, permanent for five minutes, remains. The bubbles of such a foam should not break for several seconds after the agitation is over; without this fact is closely adhered to, one may obtain misleading results. Some soaps give a thick scum, which is only distinguished from a true foam or "lather" by observation of this feature.

The number of cubic centimetres of a 1 per cent. solution of the soap required to produce the foam was termed the "scouring power" degree.

In reality all that this process effects is the precipitation of the lime salt, thus removing the hardness. Whatever name we may finally elect to give this factor it is certain that its estimation is one no soap analyst should neglect. It is certain that before a soap can act as a detergent—that is, by its own specific solvent and emulsifying action remove greasy impurities—it must first soften the water in which its action is to be made manifest. It is, therefore, surely advisable that a measure of this property should be attempted in every soap analysis which aims at completeness.

We are of opinion that the data upon which many chemists base their opinion as to the quality of a soap are either lamentably insufficient or wholly unreliable on account of the omission to ascertain the water-softening power of the sample.

These are the analyses of two samples of soap with the data usually given.

——	A.	B.
	Per Cent.	Per Cent.
Fatty acids	63·00	67·00
Free alkali	1·48	0·60
Combined soda (Na_2O)	7·35	6·83

From these figures one might easily conclude that B was much superior to A; on the contrary, as the water-softening power factor and actual trials on a large scale show, B is 20 per cent. poorer than A; or at least this—in order to obtain a lather for washing goods, five parts of B go only as far as four parts of A.

A is an excellent curd soap, B is a soap made entirely from the saponifiable portion of wool-grease, and though peculiarly excellent for producing a soft feel on goods, is defective as a cleansing agent *per se*.

From practical experience, gained by long connection with a large soapworks, we can testify to the little reliance which should be placed upon mere percentages of fat acids and alkali.

We are also not aware that any estimate based upon the ratios of the fatty acids and the combined alkalis necessarily teaches anything definite as to the value of a soap as a cleansing agent. Soaps with high or low proportions of combined alkali may be equally ineffective for water softening. It would be an easy matter to arrange a mixture of cocoa-nut oil and resin to give a soap with the same amounts of "total fatty acids" and combined soda as those present in a first-class tallow curd; but with what different properties, viewed from the soap user's standpoint! If we had only one test left to us for judging of the value of a soap we should unhesitatingly select the water-softening or "scouring power" degree.

The reactions which take place when soap solutions are added to natural waters containing lime and magnesium salts are of a very complex character. The nature of these changes was considered by one of us in a paper read before the Society of Dyers and Colorists in October 1893. The hardness of a water containing lime and magnesium salts is much less when recorded in terms of soap solution than we should expect from the action of these mineral constituents considered separately; this is due to the formation of complex salts of lime and magnesia. Observing this discrepancy, chemists have devised processes for the determination of the permanent, temporary, and total hardness by estimating the sulphates and carbonates of lime and magnesia considered as separate constituents. We doubt very much whether it is advisable to proceed in this apparently very plausible and scientific manner; it appears to us that the increased precipitating power which soaps show in the presence of these salts over that shown by them with, say, carbonate of lime only, is in this manner completely lost sight of. Through oblivion to this circumstance the accuracy of the venerable soap test has been much maligned; we trust that a consideration of the facts of the case may lead to some slight rehabilitation of a method which has much to recommend it from the technicological standpoint. Once the hardening constituents of a water have been precipitated, no matter in how complex a form, the soap subsequently used at once reduces the surface tension of the water and enables it to form films of some durability; or, to dispense with technicalities, it produces a "*lather*"—the desideratum alike of laundress, dyer, and wool-washer.

In the analysis of fats and oils intended for soap-making we make very good indirect use of the water-softening or foam-value.

We saponify 2·5 grms. of the substance with 25 c.c. of an approximately half-normal solution of potassium hydrate, and, after diluting the soap solution to 250 c.c. with distilled water, we get the foam degree on 10 c.c. of the strong Clark's hardness solution referred to above diluted with 90 c.c. of water. Pure stearic acid thus treated gives a degree of 15·3.

If we assumed that a normal reaction took place, the number of c.c. required should have been 13·0 *plus* 0·7 c.c. necessary to give a foam with 100 c.c. of pure water; but, as Dr. Teed has proved (this Journal, 1889, 256), and we ourselves have shown, one molecule of the lime salt requires more than two molecules of the potassium or sodium stearate or oleate.

As the molecular weight of oleic acid is a little less than that of stearic acid (282 : 284), it might be supposed that rather less oleate than stearate would be required to give a foam, and that we should take pure oleic acid as our standard; but in practice this is not the case, as the value of the oleic acid is practically the same as that for the stearic acid. Adopting 15·3 as the highest figure for any substance under the conditions described, we propose to calculate the water-softening degree by the simple formula—

$$X = \frac{1530}{A}$$

where A is the number of cubic centimetres of soap solution required to give the foam. The following are some of the foam or water-softening values we have obtained:—

Pure stearic acid	100·0
Pure oleic acid	100·0
Lard oil	96·0
Tallow	95·6
Bone fat (on 100 per cent. of fat)	95·6
Myristic acid	93·3
Olive oil	93·2
"Rosin," 1 part Tallow, 3 parts	92·4
Cotton oil	87·0
Palm oil (crude)	85·0
„ (bleached)	85·0
Neat's foot oil	85·0
Rape oil	79·0
Cocoa-nut oil	79·0
Arachis oil	78·5
Maize oil	76·2
Butter fat	69·5
Sperm oil (saponifiable)	68·0
Sesame oil	67·5
"Rosin" (saponifiable, part)	65·0 (mean)
„ (crude)	58·0
Wool grease (saponifiable portion)	37·0
Linseed oil	35·5
Castor oil Palm-kernel oil Cod-liver oil	?

To those who have had experience in the analysis of soaps, these figures will appear very remarkable, as they show such wide divergences in a feature of great practical importance.

Tallow is the only glyceride which gives the full theoretical foam value, 95·6, corresponding to the percentage of fat acids yielded by the sample. Olive oil contains a little linolic acid, and probably other less saturated fat acids; thus, the water-softening power of the soap is a little less than that of tallow.

The presence of some 6 per cent. of butyric acid and 2 per cent. of caproic, caprylic, and capric acids in butter-fat partly accounts for the low foam value of the soap. (Defective or dirty butter is sometimes used for soap-making.) It is to the presence of these last-named acids, with a considerable proportion of trimyristin, that cocoa-nut oil, after saponification, is so inferior to tallow in its hardness-removing properties; although, when a cocoa-nut oil soap has once removed the hardness of the water, it manifests the "lathering" property in a remarkable degree. According to Mach, resin (commercial "rosin") consists very largely of crude abietic acid; we find that the alkaline salts (soaps) of this acid possess very inferior powers for removing lime and magnesia salts; hence the low foam value. As an entirely resin soap gives with lime salts an abundant scum, easily confused with a genuine foam, it was found necessary to saponify a mixture of one part of resin and four parts of stearic acid, and ascertain the degree for the soap so obtained: knowing the factor for the stearic acid, it was an easy matter to calculate that for the resin. The commercial sample of rosin gave us only a degree of 50; but we found 12½ per cent. of unsaponifiable matter: taking this into calculation, 57 would represent the value of the crude abietic acid. There can be no doubt that the presence of so much unsaponifiable matter in resin interferes largely with the durability and volume of the foams produced by soaps containing large proportions of this substance.

Linseed oil, on account of its large percentage of isolinolenic and linolenic glycerides, gives soaps with poor water-softening properties. Linseed oil mixed with large proportions of cotton-seed oil is used for the manufacture of soft soaps; this is the reason why such soaps "do not go as far," to use the oft-repeated phrase, as soft soaps made from olive or even from cotton oil. Rape oil has a value intermediate between that of cotton and linseed oil, and does not make a good soap. We have always found that to the extent a fat or oil contains hydroxylated acids, to that extent it is of inferior quality for the manufacture of soap. Dr. Lewkowitsch was the first to disprove the widely accepted statement that neutral wool wax is a mixture of cholesteryl and isocholesteryl oleates; this authority has also shown that the fatty acids of wool grease consist chiefly of hydroxy acids and "not to any great extent of oleic acid." These conclusions are fully borne out by the very low foam value of the soap made from the pure saponifiable portion of wool grease; had this substance consisted largely of stearic and oleic acids we should have obtained a very different result.

Nevertheless wool-grease soaps have considerable value as softening agents, and, in combination with other materials rich in stearates and oleates, will find extensive application in several industries.

Cod-liver oil evidently contains only small quantities of stearic and oleic acids, and the jecoleic and therapic constituents do not give soaps of much commercial value, except perhaps for some very special purposes. The foam value of castor-oil soap is represented by a note of interrogation in our table. The hydroxylated body, ricinoleic acid, $C_{18}H_{34}O_3$, is widely different to stearic and oleic acids, and this difference is in no instance more clearly seen than in the behaviour of the soaps with lime and magnesia salts.

For a considerable period we have used the following modification of the "scouring power" process in the analysis of soaps:—

2·5 grms. of the soap are dissolved by the aid of heat in about 40 c.c. of a mixture of water and methylated spirit; this solution is made to 250 c.c. in a graduated flask. A 50 c.c. burette is then charged with this solution, and the foam value is found upon 10 c.c. of X 10 Clark's hardness solution and 90 c.c. of distilled water. The foam, obtained by vigorous shaking, should show no inclination to break even after observation for one minute. An average pure curd soap gives a reading of 28 c.c. We obtain the degrees in percentages by the formula—

$$x = \frac{2800}{A}$$

where A represents the number of c.c. of soap solution required to give the requisite foam. Some of the figures which we regularly obtain in the analysis of hard soaps may be of interest:—

—	Fat Acids.	Foam Value (Water-softening Power).
	Per Cent.	
Average pure curd	64·0	100·0
Entirely tallow curd	64·0	108·0
A palm-oil soap	55·0	90·0
A second palm-oil soap	65·5	101·8
Mottled soap	66·0	101·8
Good household soap	64·0	94·5
A cheap household soap	65·1	86·0
Superior pale soap	63·5	93·3
Carbolic soap (very resinous)	61·0	87·5
An entirely resin soap (cold process).	55·0	52·0
Oleine soap	62·0	109·0
Green olive soap	64·7	101·8
" "	67·8	103·7

We would recommend the use of from 100 c.c. to 500 c.c. of the natural water with which the soap has to be used for the determination of the foam value or water-softening power, in order that the results may be more reliable than those obtained with a pure solution of calcium chloride. Thus, the soap is given the full advantage of any peculiarly good properties it may possess with reference to the saline constituents of the water with which it has to be used.

Discussion.

The **Chairman** suggested that the rate at which the test was carried out, and the temperature, might have some influence on the "foam value." He further remarked that the term "water-softening power" would be more appropriate than "scouring-power degree."

Mr. **Sunderland** asked what practical value the method had in work, and how it affected the determination of the value of a soap for specific purposes, such as milling and softening goods. He also called attention to the fact that in washing goods the presence of free alkali was of great value in causing the cloth to grip the rollers better.

Prof. H. R. **Procter** agreed with Mr. Fairley that the term "water-softening power" would be better than that introduced in the paper. He pointed out that if the soap were used with distilled (soft) water, the "water-softening power" would give no index as to the practical value of the soap. Soaps which might not be of great value as cleansing agents, were often of the greatest service in leather-making, for softening purposes. What influence had the substitution of magnesium for calcium in the hard water upon the test? and why had a different standard been adopted for fats and for soaps?

Mr. Edw. **Halliwell** asked about the effect of sodium carbonate. It seemed to him that soap used in conjunction with sodium carbonate would have a very great water-softening power, and give a very high "foam value."

Mr. **Raper** pointed out that the value of a soap as a scouring agent depended on the nature of the dirt to be removed. For instance, a wool-fat soap of low "scouring-power degree" was very beneficial in removing coal-dust from the hands. He knew that in a case where a certain amount of soap would not give a lather with a fairly hard water, it did so on the addition of a minimal quantity of sodium sulphate. Could the better value for a stearic soap than for an oleic one be explained by assuming that hydrolysis took place to a greater extent in the former case, producing more free alkali? Also, to what cause was due the soft feel produced on goods washed with wool-fat soap? He would also like to hear something about resin soaps.

In reply, Mr. **Richardson** stated that he had carried out experiments over a wide range of temperature (15°—80° C.), but this change of temperature seemed to have no influence on the test. The presence of sodium carbonate, sulphate, and silicate seemed to be without influence on the "foam value." Even in the case of "dry soaps" made by mixing 1 part of dry powdered soap with 4 parts of best soda ash, and applied to hot Bradford city water, the entire softening influence exerted was attributable solely to the soap, and not in the least degree to the soda ash.

With regard to Mr. Raper's remark, he conjectured that in the case where the sodium sulphate had produced a decided effect, the solutions were more dilute than he himself had used. In softening natural water, sodium carbonate would not take the place of soap; but with very hard water it might have some effect, and in this case a high "foam value" might be obtained. As far as the test was concerned, it only indicated the "water-softening power," and gave no index as to the value of the soap for cleansing purposes. The substitution of magnesium for calcium in the hard water exerted no serious, but still a slight effect. A different standard had been adopted for soaps and fats, because, if the soaps were referred to the same standard as the fats relatively small numbers would be introduced. Mr. Raper's explanation of the better action of a stearic soap than an oleic soap might be justifiable; but it was more probable that the stearic soap might impart to the solution different physical characteristics (surface tension), and by diminishing the surface tension gives rise to more permanent bubbles. The cause of the soft feel on goods—at any rate, cotton goods washed with wool-fat soap—was that lanoline, wax, &c., contained in the soap were left on the cloth and formed a soft surface-layer on the fibre. In using a pure resin soap it was found that a scum was formed, and it was difficult to distinguish this from a foam. Hence the results for resin soaps were deduced from observations made with soaps prepared from known quantities of resin and another standard fat.* He did not wish to convey the idea that the water-softening power was the only feature worth consideration in soap analysis. For milling and softening purposes other properties were also desirable; nevertheless, even these properties could not manifest themselves until the hardness of the solvent medium had been removed. In agreement with the Chairman's suggestion, Mr. Jaffe and himself would adopt the term "water-softening power" as the most explanative of the test under investigation. The expression "scouring power," as he had explained, was only used because it had become very well known in the Bradford district. The soaps used were representative samples of the various classes, and were nearly all made by one firm, and the composition was in all cases accurately known. A method for the test which was tried was to run a dilute solution of calcium chloride into a known quantity of standard soap solution in such proportion that about 100 c.c. of the calcium solution was required to cause a disappearance of the lather. The end-point, however, was difficult to observe, and concordant results could not be obtained.

JOHANN CARL WILHELM FERDINAND TIEMANN.

Professor of Chemistry in Berlin University, and Editor of the Berichte der deutschen chem. Gesellschaft.

Ferdinand Tiemann was born at Rübeland in 1848. He took the Ph.D. degree at Göttingen in 1870, and in 1882 was appointed Professor of Chemistry in Berlin University, from that time until quite recently also undertaking the Editorship of the *Berichte* of the German Chemical Society. Organic Chemistry in the death of Tiemann, loses one of its ablest exponents. It falls to the lot of very few chemists to achieve, as the result of their researches, successes and triumphs which are brilliant, regarded either from the scientific or commercial point of view. This, however, has been Tiemann's good fortune for years, though doubtless at the cost of strenuous toil. His earlier work, on the preparation of artificial vanillin from the glucoside coniferin, is classic ground. In 1876 he succeeded in producing it from eugenol. But even these brilliant achievements have been eclipsed by his more recent triumph in the discovery of ionone, and a process for its commercial preparation. Other masterly pieces of research work of Tiemann's are those on the geraniol alcohols and on citral. On the latter substance he was, *par excellence, the* authority. In the realm of pure science, his researches on camphor will, perhaps, be longest remembered and most admired. It has been well said by one authority, and, no doubt, truly, that "Every page of Tiemann's work bears the impress of genius."

Dr. Ferd. Tiemann was the chief scientific member of the firm of Haarmann and Reimer, of Holzminden. In him, Chemistry, both pure and applied, has lost its ablest worker in the problems connected with perfumery substances, &c.

Tiemann was brother-in-law of the late A. W. Hofmann, and a son-in-law of Kuno Fischer.

He died on November 14th, at Meran, of heart-disease.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Ice Making and Cooling Machines, and the Chemical Media used therewith. A. Camille, London, S.E. Eng. Pat. 20,731, Oct. 1, 1898.

The vessel containing the liquid to be cooled or frozen, is enclosed in an outer vessel containing cooling mixture, and encloses an inner vessel containing a spirituous liquid, which is acted on by an air-jet from a fan or bellows. The outer vessel is made of non-conducting material, and the others of conducting material, such materials being proof against the action of the agents employed. Means are provided for agitating the intermediate vessel. The inner vessel is charged with a mixture of ether and carbon bisulphide, ether and absolute alcohol, or ammonia and glycerin, while the outer, which may only be required for auxiliary cooling, is charged with a mixture of ammonium chloride, potassium nitrate, sodium chloride, sodium sulphate, and water.
—R. A.

Cooling Liquids [Condensing Water of Steam Engines], Concentrating Solutions, and the like, Apparatus for. J. Overhoff and A. Colautti, both of Vienna, Austria. Eng. Pat. 16,663, Aug. 16, 1899.

The liquid is delivered by overflow from supply troughs on to a series of stepped surfaces, between which a current of air is drawn by means of a chimney shaft, &c. The sides of the troughs are provided with felt or other absorbent material, which first becomes saturated with the overflow from the troughs, and then allows the liquid to drop from it evenly on to the stepped surfaces. The lower surfaces project beyond those above, so that each receives a direct supply. The liquid, after passing over the surfaces, is delivered into a well or reservoir, from which it can be withdrawn by a pump.—R. A.

Cooling Liquids, and for Concentrating Solutions and the like, Apparatus for. J. Overhoff and A. Colautti, both of Vienna, Austria. Eng. Pat. 16,664, Aug. 16, 1899.

The liquid is delivered on to a series of superposed frames of louvres, between which a current of air is drawn, the louvres being arranged so that the lower edges of those above are vertically over the upper surfaces of those beneath. The louvres of the upper frame are covered with felt or the like, which supplies the liquid evenly to the louvres beneath.—R. A.

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* The authors wish to state that they have since tried the action of sodium sulphate on the power a soap possesses for producing a foam with calcium chloride solutions: even with as much as 250 grains of the sulphate per gallon the only result was to thicken *the scum*—the real foam; the permanence of the bubbles for several seconds after agitation was in no wise affected.

* Any of these specifications may be obtained by post by remitting 8*d.*—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

Casks and like Vessels, Lining and Partially Permeating Internally with Paraffin Wax. E. H. Churchill, Wendlebon Brewery, Bridgwater, Somerset. Eng. Pat. 23,445, Nov. 8, 1898.

The air is exhausted from the interior of the vessel, and the molten wax admitted, after which the vessel is closed, and rolled or tilted so as to cause the wax to flow over the interior and enter the pores. The vessel is then opened to the atmosphere and the surplus wax allowed to escape.

—R. A.

Concentrating or Drying Liquid or Semi-Liquid Substances by Evaporation, Apparatus for. J. Mecredy, London. Eng. Pat. 11,124, May 27, 1899.

The material to be treated is placed in a hollow cylinder, the ends of which are formed with openings surrounded by inturned flanges. A current of air is directed upon the inner periphery of the cylinder, through a diverging conical nozzle at one end, and the cylinder is rotated to agitate the material and expose it to the air current. The air is preferably warmed, and the cylinder may also be heated if required.—R. A.

Liquefying Atmospheric Air and Utilising the same, Apparatus for. C. E. Tripler, New York, U.S.A. Eng. Pat. 15,235, July 25, 1899.

Compressed air is supplied to the coil D of the apparatus, Fig. 1, from which it passes upwards through the pipes or coils D^2 into the chamber C^3, and then downwards through the coils C^2 into the expander A. The outlet orifices of th expander are surrounded by a baffle collar A^2, Figs. 1, 2 and 3, the outlet being controlled by the screw rods B^1 The expanded air passes upwards between the coils C Fig. 1, then through the chambers C^7, surrounding th pipes D^2, D, and escapes to the atmosphere at D^3, th air entering the apparatus being thus subjected to progressive cooling action by the air escaping. The ai liquefied passes down the outside of the expander A through the perforated dome E, and collects in th chamber B, from which it is drawn off through th pipe E^1. The pipe D and the expander A are provide with traps D^1, A^1, to intercept any foreign matters Two modified forms of expander, and another arrangement of the condensing pipes, &c., are described i the specification. These apparatus are also used in conjunction with secondary liquefiers, in which the liquid ai produced in the primary apparatus is exhausted within receiver until liquid oxygen, or liquid air rich in oxygen remains, the air from the exhausting pump and th evaporation of the liquid air or oxygen, being utilised i a series of condensing pipes and chambers to condens a supply of air, which may be employed for refrigeratin or other purposes.—R. A.

Fig. 1.

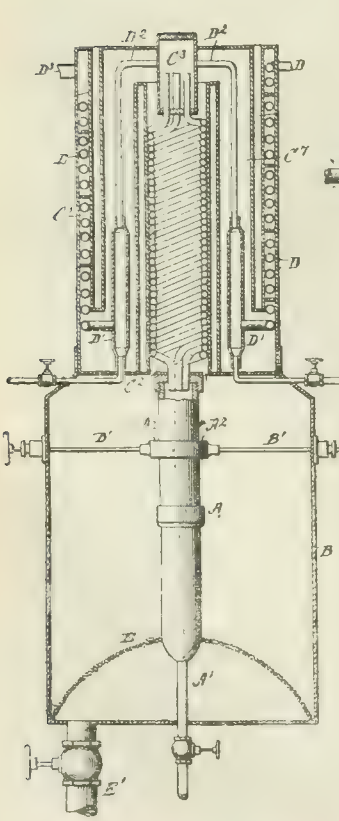


Fig. 2.

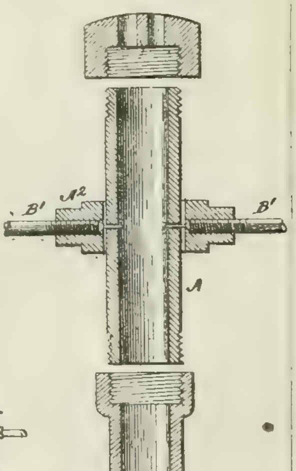
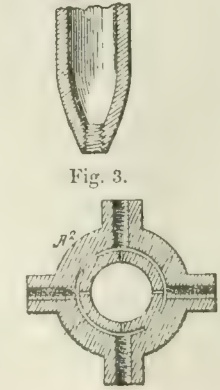


Fig. 3.



II.—FUEL, GAS, AND LIGHT.

Coke Deposits in Mexico. Board of Trade Journal, Nov 1899, 562.

The Board of Trade have received, through the Foreig Office, copy of an extract from the *San Francisco Bulletin* o September 27th last, containing an abstract from a paper rea before a meeting of the American Institute of Mining Engineers, in conference at San Francisco, on the Natural Cok Deposits of Sonora, Mexico :—

"During explorations made for the Southern Pacific Company, in the early part of this year, deposits of natural coke, of such extent and excellent quality as to be worthy of record, were found in the Santa Clara coal-field. This coal-field lies in the neighbourhood of La Barranca, a small town 95 miles north-east of Ortiz, on the Sonora Railway. The coal beds are exposed in the drainage basin of Calera creek, which empties into the Yaqui river opposite Toniche, and the old mining town of Tarahumari is nearly in the centre of the field.

"The entire area is underlain by rocks of triassic age, much disturbed in places, and cut through and covered by eruptive rocks of various kinds and ages. The coal beds occur in a series of interbedded sands and clays in the upper half of the sedimentary triassic rocks. . . .

"In our search for coal outcrops on Calera creek, we came across a fragment of coke, and tracing it up, finally found a small bed of impure coke at the mouth of the El Tren, one of the principal tributaries of that stream. A few days later, one of the prospect-slopes, driven on a supposed outcrop, opened out into a body of 3 ft. of good coke, underlain by 2 ft. of anthracite.

"Later still, as we were prospecting a creek somewhat over a half-mile west of the last, we found a place where the gophers had brought out some coal dust, and put men to work on it. Within 10 ft. it opened into a good body of coke, which at 30 ft. depth was 8 ft. thick, and at 130 ft. depth was over 10 ft. thick.

"Besides these two principal openings, which we subsequently proved to be in the same bed, we bave since located several other deposits, with thicknesses of from 2 ft. to 4 ft. It is possible that the coke is not entirely due to the effect of igneous rock. One bed of coke has, so far as we have found, no igneous rock near it; and again, at one locality, there are small pockets of coke in a 4-ft. seam of anthracite, and, so far, we have not found any intrusive rock in the immediate vicinity. These pockets are about the centre of the seam, and are small; but the coke is of good quality. Corresponding, in a way, to the occurrence of the coke in the anthracite, we find, for the first 50 ft. or 60 ft. in the gopher slope, a little anthracite in pockets at the base of the coke.

"The occurrence of coke and coal in the same bed, but in separate benches, is also noticeable. This is found in three separate localities, and in different beds. In two cases the coke forms the upper bench, and in the other the coal is on top. In the first opening mentioned above the two benches are separated by a clay parting 3 ins. thick. In the other two I did not find any parting.

"Where the coal is crushed a little graphite is found along the lines of fracture. I have not found it elsewhere in the beds. Some of the anthracite of the region also has a little graphite in similar relation; and there are several localities where the entire bed is altered to graphite. The occurrence in the coke seam is interesting, however, as it shows that in the cumulative transformation from vegetable fibre to graphite the passage may be either through anthracite or through natural coke.

"The coke is dark-grey in colour, of even texture, with small pores (denser than most oven coke), and very firm. It breaks with very even fracture, but has in places the columnar structure of oven coke well developed.

"It is an excellent fuel, burning without any sparkling or deflagration. It is little or no harder to ignite than the anthracite, and burns well in an open fire, in the blacksmith's forge, and in the assay furnace. The ash is white.

"The value of these coke beds is largely due to the fact that the intrusives are so regularly interbedded, running for long distances in the same bed of coal slates. This gives promise of a far greater supply of coke than could be hoped for under other conditions, and gives to the deposit, in this region, where there is no coking coal of any kind, a decided commercial importance."

Peat, Utilisation of Belgian. A. Petermann. Bull. Assoc. Belge des Chim. 13, [7], 330—342.

Although extensive deposits of peat are met with in Belgium—principally in the Ardennes, Flanders, and Campine—they are not utilised industrially, except for merely local requirements. To ascertain the fitness of this abundant raw material for the various uses to which peat is adapted in other lands, the author was commissioned by the Belgian Woods and Rivers Department and the Ministry of Agriculture to study the properties of the various deposits. In his report he divides them into two main classes, Ardennes and Campine peats, the former characterised by richness in nitrogen (average 1·8 per cent. referred to dry matter). Moreover, the Hertogenwald peat from this district, though too poor in spongy fibre to form good litter, contains a considerable proportion of woody matter, principally birch residue, and, when distilled at about 450° C. in iron retorts, furnishes the following products per 1,000 kilos. of air-dry peat: coke, 337·5 kilos.; methyl alcohol, 600 c.c.; acetic acid, 3·058 kilos.; tar, 57·665 kilos., the last-named yielding on fractionation—

	Grms.
Oil distilling between 90° and 100° C.	2,500
„ „ 100° „ 200° C.	12,750
„ „ 200° „ 300° C.	17,000
Paraffin	14,425
Carbon	11,000

The yield of ammonia (921 grms.) is much less than corresponds with the percentage of nitrogen in the peat, but the carbon residue contains cyanides and decomposition products of organic bases. A considerable volume of illuminating gas is also liberated, 2 kilos. of peat in one experiment having furnished enough to supply a bright flame for six hours.

The peat from the plains of Campine is generally of a more earthy character, containing from 27·6 to 60·79 per cent. of ash, whilst Ardennes peat yields only 1·20—7·52 per cent. This property, however, conjoined with their considerable power of absorbing moisture (100—200 per cent.), fits them for use as an adjunct to straw litter. The calorific value is too low for them to form a useful fuel. An exception to the general character of Campine peats is furnished by the Réthy deposit, which consists of 77·09 per cent. of organic matter, 19·02 per cent. of moisture, and only 3·89 per cent. of ash.—C. S.

Petroleum and Peat Fuel. W. Aleksiejew. Mem. der kais. russ. techn. Ges. 1899, [4]; Allgem. Oesterr. Chem. u. Techn. Zeit. 17, [18], 5.

To remedy the inconveniences attaching to peat and petroleum when used separately as fuel, the author proposes to imitate the process employed by Valnas and Hennebutte for coal-petroleum briquettes, namely, to gelatinise the oil by means of magnesia soap, and impregnate peat blocks with this preparation. The peat blocks are steeped for five minutes in the prepared oil, of which they absorb from 10 to 30 per cent. of their own weight, the amount taken up being in inverse ratio to the quality of the peat. No pressing is required, and it is claimed that the briquettes are safer to store than ordinary peat, being incapable of self-ignition, nor can they be set alight by a glowing splinter; also there is no loss of oil by evaporation during storage.

It is considered that such fuel would be suitable for use in gas generators—particularly if the briquettes were impregnated in a moist condition—as there is no fear of any distillation of the petroleum occurring when in use.

—C. S.

Coke-Oven Gas, Utilisation of, for Illuminating Purposes. Stahl u. Eisen, 19, [13], 614—617.

The greater difficulty experienced in keeping the walls of coke ovens air-tight than is the case with gas retorts, lowers the illuminating value of the gas produced in the former. The results obtained in the coke ovens at the Mathias Stinnes Colliery (this Journal, 1899, 476) show, when compared with Bunte's analyses of retort gas, that in both methods of distillation the general course of the operation is the same, the proportion of heavy hydrocarbons and methane decreasing as distillation progresses, whilst the amount of hydrogen becomes larger.

The coals rich in gas, yield an inferior coke, unless heated to a temperature some 200°—300° C. higher than usual, in which case a larger consumption of gas under the ovens is necessary, and consequently the available excess for lighting is correspondingly diminished. An important part is also played by the moisture present in the coal. Thus, 15 per cent. of water—a not excessive proportion—means that in a works of medium size, about 45 to 50 cb. metres of water have to be evaporated per diem, involving a consumption of heat which expresses itself in a decreased production of gas.

In view of the considerable divergences in the character of the gas liberated during the various stages of coking, it is considered that, where there is a good market for the coke, the adoption of the method proposed by Grahn and Hegener for utilising the earlier and more carburetted gases for lighting, and the final and more hydrogenised portion for heating, would be advantageous.—C. S.

Dellwik's Water-Gas Process. G. Lunge. J. f. Gasbeleucht. 42, [36], 593—597. See also this Journal, 1899, 897—899.

The author refers to earlier communications by Vivian B. Lewes (this Journal, 1898, 564) and others on the Dellwik water-gas generators in use at Warstein. He then proceeds to discuss three questions, *viz.*, (1.) Why earlier inventors were content to raise the heats of water-gas generators by burning the carbon by means of the air-blast, to carbonic oxide. (2.) What means Dellwik adopted in order to burn the carbon almost wholly to carbonic acid. (3.) How the commonly accepted theory of the process of combustion needs to be modified to become applicable to the facts established by Dellwik.

On the first question, the author says that earlier inventors considered the production of carbonic oxide by the air-blast unavoidable. The process of raising the heats by the air-blast was similar to the production of producer-gas in Siemens' producers, with which they were familiar. Utilisation of the producer-gas or carbonic oxide formed in raising the heats was often attempted, but its bulk was usually too great for local consumption, and it was not worth leading to a distance.

In order to answer the second question, the author visited the Warstein installation of Dellwik generators for the purpose of investigation. It comprises 26 sets, capable of producing a total of 30,000,000 cb. m. of water-gas per annum. A trial run, lasting from 8.38 a.m. to 2.22 p.m., was made on one generator, which was capable of making 100 to 120 cb. m. per hour. The generator had been previously brought into proper condition for work. The depth of the bed of fuel—both at the start and at the finish—was 1·2 m. There were two charging hoppers placed on a stage, one on each side of the body of the generator, and opening, by means of sliding valves, into inclined shafts leading into the upper part of the generating chamber. The hoppers were opened, and the shafts filled with coke to the level of the valves after every third run (gas-making operation), so that the generating chamber was kept constantly charged to a uniform level. The plant was provided with steam inlets and gas outlets at both top and bottom, and reversing gear, so that runs might be made alternately upwards and downwards. Twenty-six runs were made, each of from 8 to 10 minutes' duration, and the air-blast between consecutive runs was continued for $1\frac{3}{4}$ minutes. A run was interrupted, and the air-blast turned on as soon as the flame of a jet of the produced water-gas diminished in size owing to the presence of considerable quantities of carbonic acid and steam. The pressure of the air-blast was 245—260 mm., and that of the products of combustion above the bed of fuel was 105—115 mm.; hence the drop in pressure was about 140—150 mm. (of water). The fuel was maintained at bright redness, and 245 kilos. of coke were used in the course of the trial, producing 702 cb. m. of water-gas, measured under the prevailing atmospheric conditions, for which a reliable correction of volume to 0° and 760 mm. was not possible. After making an ample deduction on this account, it was found that the make of gas was not less than 2·5 cb. m. per kilo. of coke used. The composition of the blowing-up gas is given (this Journal, 1899, 898), as also that of the water-gas produced, following which is the author's explanation of the far greater efficiency of this apparatus and process.

The third question is also substantially answered, *loc. cit.* It is shown that a large excess of oxygen raises the temperature of dissociation above that which holds good ordinarily, and consumes any carbonic oxide, so that the latter cannot exist in the products. Such an excess of oxygen appears to be present during the air-blast in the Dellwik process. The theory propounded could be substantiated by determinations, in both Dellwik and older generators, of the amount of oxygen which passes in unit time over a certain area of incandescent carbon, or, that is to say, of the rate of flow of the current of air. But such determinations could not be made with any pretence to accuracy, and therefore, for the present, it cannot be said that a certain stated amount of oxygen, or rate of air-flow, effects the combustion of carbon to carbonic acid at temperatures exceeding 1,000° C., and with a deep bed of fuel. It must suffice in practice to determine empirically, by analyses of the gases, the pressure of the air-blast by which combustion to carbonic acid takes place with any particular height of the bed of coke or anthracite.—J. A. B.

Acetylene, The Purification of. N. Caro. J. für Gasbeleucht. **42,** [37], 616—618.

The author challenges statements made by F. Ullmann (this Journal, 1899, 743), which controvert earlier statements by the author. He points out that Ullmann's researches were made on acetylene in which sulphur was present only in organic combinations, and phosphorus, presumably, for the most part in a similar state. The acetylene used by the author contained sulphuretted hydrogen. The crude gas, therefore, was not alike in the two cases, and for this reason, as well as on account of Ullmann having used kieselguhr saturated with the purifying agents in place of applying the latter directly in washers, the author considers it not surprising that their observations were not in accord. The author points out that he had stated that solution of cuprous chloride did not remove certain organic sulphur compounds which were sometimes present in acetylene, and that the same remark applied to Ullmann's chromic acid material, but that the sulphur compounds unaffected, wer not the same in both cases. The author has found grea variations in the nature of the impurities in crude acetylen and considers that it is unsafe to draw general conclusion on purification from the results of only one or two exper ments.

F. Ullmann's reply:—Acetylene generated by droppin carbide into water is invariably free from sulphurette hydrogen, and acetylene is very commonly generate in this manner. The removal of sulphuretted hydroge from crude acetylene presents no difficulty, howeve as the materials used for its removal from coal ga are available. There is no ground for assuming tha organic phosphorus compounds occur in acetylene. Car has stated that a 2 per cent. solution of chromic aci purifies acetylene, but a repetition of his experiments b the author (Ullmann) did not confirm this statement. Th use of kieselguhr saturated with the purifying agents, i place of the latter in washers, is defensible on the groun that the kieselguhr mass breaks up the gas into fine particles, and presents a greater area to it than does a liqui applied in washers. The methods by which the value o the chromic acid purifying material was established (thi Journal, 1899, 743) are, Ullmann states, not discredited b Caro's criticism.—J. A. B.

Acetylene, Rapidity of the Explosion of. Berthelot an Le Chatelier. Comptes Rend. 1899, **129,** [9], 427—434.

The rapidity of the explosion of pure acetylene containe under pressure in glass tubes, 1,000 mm. long and 2 t 6 mm. wide internally, was observed by aid of the recor of the explosion on a photographic plate which was mounte with its lens in a frame. This frame was automaticall dropped at the moment when 0·01 to 0·04 grm. of fulminate by which the gas was exploded, was electrically fired, an it fell vertically in suitable guides. The plate showed th image of the flame, which traversed the tube, as a curve from the inclination to the horizontal of the tangent to which at any point, the rate of propagation of the explosio at that point could be calculated. A straight line, more o less inclined, indicated uniform rate of propagation. On end of the glass tube was closed, the other was fitted to a iron tube in which the morsel of fulminate was placed. The explosion of pure acetylene broke the glass tubes in al cases, whereas that of mixtures of oxygen and combustibl gases did not. The rate of propagation of the explosion o such mixtures becomes uniform, but that of acetylene wa observed to increase up to the moment when the tub broke. It appears that the thermodynamic and chemica changes which bring about the production of the explosive wave also propagate the explosion in an endothermic gas, such as acetylene, which is thereby resolved into its elements, at a rate of 1,000 to 1,600 metres per second. The rate increased, within these limits, as the pressure of the gas in the tube was raised from 5 to 30 atmospheres.—J. A. B.

Calcium Carbide, Estimate of Cost of, with various Prime Movers. F. Liebetanz. Zeits. Elektrochem. **6,** [6], 117—122.

A report of the paper upon this subject read by the author at the Buda-Pesth Acetylene Congress in May 1899.

In this paper the author propounds the question as to the relative economy of water-, steam- and gas-power when used under the most favourable conditions for carbide production, and discusses the influence of freight charges upon the relative costs.

The estimates are based upon an output of 1,000 kilos. of carbide per day of 24 hours, it being assumed that an energy efficiency represented by 5 kilos. of carbide per K.W. day is obtained in the furnace.

Water-power is calculated to cost 2*l.* 10*s.*, and steam-power 5*l.* 8*s.*, per E.H.P. year, whilst the flow of water in rivers is stated to be capable of utilisation for power purposes at a cost of 3*l.* 14*s.* per E.H.P. year.

The details of capital outlay and of working cost for these three sources of power are summarised by the author as follows:—

——	Water-falls.	Steam.	River Flow.
Plant and machinery	6,750*l.*	2,800*l.*	3,750*l.*
Annual working costs.......	675*l.*	1,464*l.*	1,000*l.*
Daily working costs	45*s.*	98*s.*	67*s.*
Cost of the E.H.P. year at the furnace electrodes.	50*s.*	108*s.*	74*s.*

The above estimates are for a plant yielding 200 K. Watts at the furnace, or 450 h.p. at the shaft of the prime mover.

For 1,000 kilos. of carbide, a consumption of 1,300 kilos. of coke, and 1,400 kilos. of lime is estimated.

Adding the cost of these to the costs of power given above, the author obtains the following total costs per 1,000 kilos. of carbide :—Waterfalls, 8*l.* 18*s.* ; steam-power, 11*l.* 14*s.*; river flow, 9*l.* 15*s.*

No estimates are given for the cost of carbide when using producer-gas, or the waste gases of blast furnaces for power generating, but the author discusses the latter method of carbide production at length, and states the opinion that it will develop into a great industry.

At present, though water is the cheaper source of power, yet owing to the high costs of carbide distribution, carbide factories using steam-engines for driving the dynamos, can be made to pay in many neighbourhoods remote from the larger water-power stations.—J. B. C. K.

PATENTS.

Liquid Fuel, Burning without Smoke in Steam Boiler Furnaces and the like, Apparatus for. R. Gregory, Islington. Eng. Pat. 22,642, Oct. 28, 1898.

This apparatus may be used by itself for heating steam boilers, but is shown in the drawings attached to the specification, as used along with coal or other fuel, so as to rapidly produce steam, as required at electric lighting stations, or to facilitate combustion in destructor furnaces. It consists of an air chamber bolted to the face plate of the furnace, the upper bell-shaped end of which is covered with one or more layers of gauze, through which the air enters. Within the air chamber is an injector, consisting of an oil chamber connected to a supply hopper, which receives a regulated quantity of liquid fuel from an overhead store tank. The oil chamber has a nozzle which is surrounded by a small chamber connected with a cock-governed steam pipe coming from the boiler of the furnace. From this small chamber, a tube, called a mixer, leads into the furnace, which tube is surrounded by another longer one, called the vaporiser. The latter is connected to the air chamber, and its inner end is formed as a spreader, so as to diffuse the combined jet of air, steam, and liquid fuel over the entire width of the furnace, and in the example shown, directing the jet upon the solid fuel to be burned.—R. S.

Liquid Fuel for Heating Purposes, Apparatus for Burning. C. H. Fisher and F. May, London. Eng. Pat. 25,399, Dec. 1, 1898.

The apparatus consists of a flat chamber, having a tortuous or sinuous channel of gradually increasing area. Into the outer portion of this channel, the liquid fuel is forced, and from the centre the vapour leaves through an orifice to a burner having lateral orifices. A pilot burner or auxiliary vaporiser is combined with the burner.—R. S.

Hydrocarbon Oils for Heating Purposes, Combustion of. T. Tomlinson, Bray, Ireland. Eng. Pat. 25,629, Dec. 5, 1898.

The oil used is divided into two parts, a smaller part, which may be a light oil for vaporising purposes, and a larger part, which may be a heavy mineral oil or oil refuse. The air is also subdivided after leaving the blower. One portion of the air passes to a coil, and is heated by a small flame. After the process has been in action for a time, this part may be heated by the burner itself. The heated air then passes through a nozzle and withdraws and vaporises the light oil. The mixture passes on, receives through an annular pipe a fresh supply of air, and is suitably ignited. The products of combustion pass on, and receive through an annular opening a fresh supply of air, the current being sufficient to withdraw the main supply of oil from a tank and vaporise it. The mixture of products of combustion, air, and oil, still flows onwards, receives the main air supply through an annular opening, and is ignited. The products then pass directly to the furnace or the like.—R. S.

Hydrocarbon Burners. E. E. Crook, Indianopolis, U.S.A., and M. A. Hunting, Hamilton, Canada. Eng. Pat. 24,995, Nov. 26, 1898.

These burners, of the kind for use with cooking stoves, consist of a doubly convex, circular, or elliptical casing, into which the oil is led from a tank, and in which it is vaporised by a flame beneath. The casing has a central vapour tube passing completely through it. Internally the casing is provided with radial and other flanges or partial partitions. The vapour given off, is carried by a tube downwards, inwards, and then upwards, so as to be projected immediately beneath the vapour tube. The vapour tube is covered, above the vaporising chamber, with a cap or spreader having slots in its outer edges through which the vapour and air pass, and where they are ignited. Surrounding the spreader is a vertically adjustable plate to project the flame upwards or downwards as required. The initial heating of the vaporiser is effected by an oil flame. Oil is led to an annular channel in a pan beneath the vaporiser and surrounding the central admission pipe for vapour. An adjustable asbestos or other wick dips into this oil, and the auxiliary burner thus formed is surrounded by a hood having a sliding door. The pan is formed with concentric ribs, and if it be desired to start the main burner quickly, the oil may be flooded over the whole pan and be ignited in the usual way.—R. S.

Automatic Gas Lighters. D. J. Archer, Toronto, Canada. Eng. Pat. 13,613, June 30, 1899.

This invention consists of a device attached to the gas burner, so that the gas is ignited by the act of turning it on. The gas, after passing the plug, rotates a small paddle placed above. A smaller paddle on the same axle, but outside the burner, also rotates, and in doing so rubs against the frayed or spread out ends of one or more fine wires. These wires become hot, and a loop of the wire, which is placed just above the burner, ignites the gas. The special features claimed are the wires, portions of which extend into the path of the gas, a support for the wires of carbon, soapstone, or the like, the frayed ends to the wires, and the means for causing friction at the ends.—R. S.

Gas, Manufacture of, and Apparatus therefor. H. H. Lake, London. From F. L. Slocum, Pittsburgh (Pa.), U.S.A. Eng. Pat. 22,020, Oct. 19, 1898.

The apparatus comprises two generators and a series of return pipes enclosed in other pipes whereby the gases passing to the generators are heated by the effluent gases therefrom, and includes means (pipes and valves) for reversing the currents between the generators, as well as for the separation of by-products from the gas by passing the latter successively through a shower of water, acidified water, and a body of incandescent carbon.—C. S.

Gas from Town Refuse and Sweepings, Method of Producing, and Apparatus therefor. E. Pilous, G. Ottermann, and E. Nauheim, Vienna. Eng. Pat. 25,209, Nov. 29, 1898.

This is a method of producing gas "composed essentially of hydrogen and methane, consisting in distilling refuse street sweepings, ashpit refuse, and the like organic substances at temperatures of between 800° to 1,000° C., the gases produced being constantly removed over the heated material." The residue from this dry distillation in one of the retorts is, whilst still glowing, treated with water spray, in such proportion that a mixture of steam and water-gas is produced, the mixed gases being then converted into water-gas by passing them through the corresponding residue in the second retort.—C. S.

Water-Gas, Manufacture of. A. J. Boult, London. From G. Nicolini, Rome. Eng. Pat. 25,277, Nov. 30, 1898.

To dispense with the usual steam generator, the inventor replaces the ordinary fire-brick lining of the gas generator by a metallic water-jacket, the steam formed therein being dried by passage through a coil within the generator and conducted to an injector below the firegrate.—C. S.

Lighting, Heating, and Power Gas, A Method and Apparatus for Producing. H. S. Elworthy, St. Heliers, Jersey; and H. Lane, Birmingham. Eng. Pat. 25,771, Dec. 6, 1898.

The method claimed is for "producing alternately air-gas and water-gas in coupled producers, consisting in blowing (preferably warmed) air through incandescent fuel, and passing the combustion products through a regenerative chamber, and then reversing the direction of the current and passing steam through the heated regenerator chamber and the incandescent fuel for the production of water-gas with concurrent operation of the coupled producer in the reverse direction." The apparatus employed consists of a pair of generators, each surrounded by a regenerator of firebrick or other refractory material with a large surface, and passages or perforations for the passage of the products of combustion.—C. S.

Gas, Manufacture of. W. B. Johnson, Liverpool. From J. A. Faux, Pittsburg (Pa.), U.S.A. Eng. Pat. 16,036, Aug. 5, 1899.

The principal features claimed in this apparatus for producing (chiefly) combined coal- and water-gas on the intermittent system are: the employment of a fuel bed (coke) of greater area at the top than at the bottom (funnel-shaped generator), on which bed a thin layer of coal is spread by a special feeding device (a double, rotating slotted disc). Steam is admitted below the fuel bed and an up-draught maintained by means of an exhaust, which draws off the combined gases at a low temperature, through several ports above the coal layer, and discharges them to a pair of fixers, condensing and scrubbing plant, provision being made for the return of a portion of the gas from the scrubber to the upper end of the second fixer in order to lower the temperature of the gas therein and prevent deposition of tar in the outlet pipes.—C. S.

Compressed [Illuminating] Gas, Process, and Apparatus for the Production of. W. Knapp and R. Steilberg, Hamburg. Eng. Pat. 16,618, Aug. 16, 1899.

The gas is mixed with a controllable proportion of air by means of a pump, which forces the mixture into a vessel divided into two compartments by a horizontal partition. The lower compartment is charged with a liquid (preferably glycerin), which is forced by the pressure of the gas to ascend a pipe and enter the upper compartment, whereby it exerts a uniform pressure on the gas delivered to the service pipe. When the liquid attains a certain level in the upper compartment, the supply of gas from the pump is cut off by the action of a float valve, an additional cut-off in the suction pipe being actuated by the overflow liquid in case of failure on the part of the float.—C. S.

Incombustible Lamp Wicks, Process for Producing. M. Ehrenbacher, Berlin. Eng. Pat. 15,078, July 21, 1899.

The claim is:—"A process for rendering lamp wicks incombustible and increasing the suction powers of the same, which consists in first saturating the wick with a solution of a magnesium salt, then treating the same with a solution of an alkali or alkali salt, and thus producing a precipitation of an insoluble salt of magnesium on the fibres of the wick substantially as described."—R. S.

Metallic Carbides, Process of Manufacturing. H. L. Hartenstein, Chicago, U.S.A. Eng. Pat. 16,128, Aug. 8, 1899.

A mixture of blast furnace slag, limestone, and a carbonaceous material, such as carbon, is subjected to the action of an electric current to produce metallic carbide. The limestone and carbonaceous material, preferably in a finely divided state, may be added to the slag when molten, or mixed or diffused into it as it runs from the blast furnace, and the molten mixture, in these cases, subjected to the action of the current (this Journal, 1898, 444).

—A. W.

Acetylene Generators. H. Drivet and J. Bilbie, both of London. Eng. Pat. 17,734, Aug. 17, 1898.

On the top of a water tank are mounted a bell gasholder floating in an annular seal and having its interior open to the tank, and two receptacles containing powdered carbide. The descent of the gasholder operates through racks and toothed rollers, a coffee mill mechanism in each carbide receptacle, and carbide is thereby discharged into the water in the tank. The gas generated raises the gasholder, which operates in its ascent a bell-crank lever by which the operation of the carbide distributing mechanism is arrested until the gasholder again descends.—J. A. B.

Acetylene Lamps. G. Marshall, Birmingham. Eng. Pat. 19,518, Sept. 14, 1898.

A water reservoir screws into the lower end of the lamp chamber, in which is placed a cartridge containing carbide. A wick extends through the cartridge into the water reservoir, and conveys water thence to the carbide. The wick passes through telescoping sleeves on the bottom of the cartridge and the top of the water reservoir.—J. A. B.

Carbide Supply Holders for Acetylene Generation, and Lamps to be used in connection therewith. F. Sunderland and G. Marshall, both of Birmingham. Eng. Pat. 4087, Feb. 24, 1899.

The apparatus described in foregoing patent, is modified by weighting the lower end of the wick in order to keep it extended, and by providing an inwardly cupped bottom of flexible material for the casing of the carbide cartridge. The expansion of the carbide in the course of its decomposition merely flattens the bottom of the casing in place of acting on the sides of the chamber.—J. A. B.

Acetylene Gas Generators, and Lamps for Burning such Gas. R. H. Sunderland and G. Marshall, both of Birmingham. Eng. Pat. 4093, Feb. 24, 1899.

A bell gas-holder floats in an annular water seal which surrounds a carbide holder, in the bottom of which is a conical valve, which is normally kept closed by the force of a spring acting on the upper end of the valve rod, which passes up through the carbide holder. When, however, the gas-holder bell descends to a given point it comes in contact with the top of the valve rod and counteracts the force of the spring, thereby permitting carbide to pass through the valve into water in a subjacent generating tank, from which the gas formed passes to the gas-holder or the burners, which in portable apparatus may be placed on a cap which surmounts the extended outer wall of the water seal.

—J. A. B.

Acetylene Gas, Apparatus for the Manufacture of. J. V. Robinson, Malahide, County Dublin. Eng. Pat. 19,674, Sept. 16, 1898.

An open-topped vessel containing carbide, and with holes at different levels in its sides, is placed within a bell, on the crown of which is an exit pipe with cock, and the bell is immersed, and retained by catches, in a tank of water. On opening the cock, the air within the bell escapes, and water rises and flows into the carbide vessel through one or more of the holes in its sides, whereupon gas is generated and depresses the level of the water below that of the holes until the gas is led off for consumption.—J. A. B.

Acetylene Generating Apparatus and the like. D. J. Van Praag, London, and F. W. Harker, Maidenhead. Eng. Pat. 21,691, Oct. 14, 1898.

Beneath the tank of a gas-holder is a casing containing a carbide receptacle, to which water is admitted through a telescoping pipe from a superposed water tank. The upper portion of the telescoping pipe is attached to the crown of

the gas-holder and moves with it. When the gas-holder has risen to a certain height the top of the pipe comes in contact with a cap, which rests on a perforated case within the water reservoir, and lifts it from its seat. The cap closes the pipe, and stops the supply of water to the carbide until the gas-holder descends. In a modification of the apparatus for use as a cycle lamp, a conical valve at the base of the water reservoir is regulated by means of a valve rod which extends through the top of the reservoir. A feed wire passes through the nozzle of the valve.
—J. A. B.

Acetylene Generating Apparatus, and Lamps for Use in connection therewith. D. J. Van Praag, London, and F. W. Harker, Maidenhead. Eng. Pat. 2227, Jan. 31, 1899.

The improvements refer to apparatus of the type claimed under the foregoing patent, and comprise a carbide receptacle divided into compartments, having the water-feed arranged relatively thereto, so that the water may be caused to act on the carbide in any one of the compartments. Modifications of the apparatus as applied to lamps are also described.
—J. A. B.

Acetylene Gas, Apparatus for Generating. G. A. Gilmer, Paris. Eng. Pat. 23,230, Nov. 4, 1898.

An annular bell gas-holder receives the gas generated in one or more generators, each comprising a carbide receptacle, enclosed by a fixed bell, placed in the central cavity of the gas-holder. Water is supplied to the generators from the tank of the gas-holder, and is forced downwards out of contact with the carbide therein, whenever the pressure of gas within the fixed bell rises beyond a certain limit. Cocks on the gas exit pipes from the fixed bells serve to put one or more generators in or out of action.—J. A. B.

Calcium Carbide for Use in the Manufacture of Acetylene, Preparing. E. S. Bond, Handsworth, Staffs. Eng. Pat. 23,346, Nov. 7, 1898.

A cylinder formed of spirally-coiled wire, with ends either of coiled wire or perforated plates, contains a paper bag in which is carbide. The cylinder extends lengthwise as the carbide expands in the course of its decomposition by water, and thereby prevents clogging, and facilitates access of water to the interior of the charge of carbide. Prongs may pass through the sides of the cylinder in order further to aid the breaking up of the charge of carbide.—J. A. B.

Acetylene Gas Generators. P. Margulies, Odessa, Russia. Eng. Pat. 24,065, Nov. 15, 1898.

Water is supplied from a reservoir to a vessel containing carbide, through a pipe in which is a cock, which is closed when the pressure of the generated gas in the pipe leading to the gas-holders rises above a certain limit, and distends a flexible membrane, which operates the lever of the controlling cock. The gas passes to two gas-holders, of which one only supplies the burners, and the inlet to this gas-holder is controlled, so that it is closed whenever the pressure within reaches a certain limit. The gas generated then passes to the second gas-holder only, and thence it escapes to the holder which supplies the burners as soon as the pressure in that holder has decreased to an extent sufficient to permit its inlet cock to re-open.—J. A. B.

Acetylene Gas Generator. C. J. Watts, Guernsey. Eng. Pat. 3102, Feb. 11, 1899.

A carbide container, either wholly, or as to its lower part, made of porous porcelain, is provided with a gas-tight detachable cap, with a pipe leading to the burner, and is immersed in water, which gains access to the carbide through the porous walls of the container and causes evolution of acetylene, which passes away to the burner.—J. A. B.

Acetylene Gas Burner. G. Geisseler, Neuveville, Switzerland. Eng. Pat. 7200, April 5, 1899.

A burner tip, preferably made of precious stone, such as sapphire, ruby, garnet, &c., has an orifice for the outflow of gas, and is surmounted by a cap with a corresponding, but rather larger, orifice. Lateral holes in the cap admit air to the space between the burner and cap, where it mixes with the outflowing gas. The flame is produced at the orifice in the cap, and the heat of the flame may necessitate occasional renewal of the cap, but the other parts of the burner will, it is claimed, last indefinitely.—J. A. B.

Acetylene Gas, Apparatus for Use in the Generation of. P. C. Saule, Tulle, France. Eng. Pat. 10,862, May 24, 1899.

An inclined generating tank placed beneath a gas-holder is fed with balls consisting of, or containing, carbide, through an inclined spiral trough which passes round the gas-holder. The bell of the latter carries two forks, which enter the trough when the bell descends to a certain point. One fork retains in position all the balls except the foremost, while the other fork releases a catch and allows the foremost ball to drop into the generating tank. The gas evolved in the latter is directed by means of a baffle plate to an outlet which leads into the gas-holder. Each time the bell descends owing to consumption of gas, one ball is discharged into the generating tank.—J. A. B.

Acetylene Gas Generators. P. Lacroix, Paris. Eng. Pat. 13,924, July 5, 1899.

Water flows from an overhead cistern down one limb of a U-tube, and up to a cock in the other limb, which communicates at top with the gas-holder which receives the gas generated. The cock has a through way not less in section than the U-tube, and a way at right angles which is of much smaller section. When the large through way is open, the water in that limb of the tube is subjected to the pressure of the gas in the gas-holder, which is of the displacement type, or otherwise so designed that the pressure on the gas increases with the volume of gas stored in it. When the pressure in the holder is considerable the water does not reach the cock; as the pressure falls it reaches first to the small way, whereby it passes to one generator; and on further decrease of the pressure the water passes up the large through-way, and flows into a second generator also.
—J. A. B.

Acetylene and other Gases, Apparatus for the Generation and Distribution of. E. Quelle, Paris. Eng. Pat. 14,240, July 10, 1899. (Under Internat. Convention.)

Carbide is supplied from a hopper to water in a generating tank by means of a valve, which is operated through a rod, which passes through a stuffing box into an oil bath in which it is connected with a lever, which is actuated according to the movements of the gas-holder which receives the gas generated. The maintenance of a bath of oil above the stuffing box is said to prevent escape of gas through the latter, and to diminish the wear and tear.—J. A. B.

Acetylene Gas Generators. C. W. Söderberg, Christiania, Norway. Eng. Pat. 14,499, July 13, 1899. (Under Internat. Convention.)

A number of carbide receptacles are arranged in a circle above a generating tank containing water. A hinged flap forms the bottom of each receptacle, and is held in position by a horizontal disc which covers the generating tank. In this disc is a slot, and in the course of the rotation of the disc by mechanism actuated by the descent of the gas-holder into which the gas generated passes, this slot passes beneath each carbide receptacle in turn, and allows the flap to fall and the carbide to be discharged through a water-sealed shoot into the water in the generating tank.—J. A. B.

Acetylene and other Gases, Apparatus for Producing and Storing. C. M. Bridges, San Francisco. Eng. Pat. 14,984, July 20, 1899.

Carbide is discharged from a hopper into water in a reservoir through an orifice in an arc-shaped slide, which swings so as to bring the orifice beneath, or remove it from the lower end of the hopper in unison with the movements of the bell into which the gas eventually passes. This bell is sealed by a flexible sleeve which fits closely round a cylinder, into which the gas passes from the generating reservoir, and from which it escapes through perforations into the bell.—J. A. B.

Acetylene Gas, Gas Burners specially adapted for. D. M. Steward, Chattanooga, U.S.A. Eng. Pat. 15,344, July 26, 1899.

A steatite head has two stems pointing obliquely upwards. Each stem has an annular flange in which air mixes with the gas, and the mixture issues through an enlarged opening so placed that the jet impinges on the jet from the opposite stem, and forms a flat flame between the two stems. In another form, a number of stems protrude horizontally from the head; each stem has two openings so placed that a flat flame is formed between two adjacent stems.
—J. A. B.

Acetylene Gas Generator. L. Bartmann, Berlin. Eng. Pat. 15,406, July 27, 1899.

Carbide is contained in a chamber with perforated sides, and a piston-like top, which is pressed down on the contents by the force exerted by a spring, so that the residual product is forced out of the chamber. The chamber is fixed under a bell, which dips in a tank, which communicates at foot with an external annular tank, into which water is forced from the inner tank, when gas accumulates beneath the bell. On the water in the inner tank there floats a layer of oil, which interrupts the action of the water on the carbide except when the carbide is below the level of the layer of oil. Beneath the apparatus is a tank containing acetone, provided with a pipe opening below the normal level of the water in the inner tank. In the event of excessive production of gas the mouth of this pipe becomes exposed to the gas, which thereby is free to enter the acetone tank, and to be absorbed by the acetone.—J. A. B.

Packing Calcium Carbide, and Generating Acetylene Gas therefrom. E. J. Dolan, Philadelphia, Pa., U.S.A. Eng. Pat. 15,506, July 28, 1899.

In order to control the rapidity of decomposition of carbide by water, and to retain the residue in a small compass, carbide is wrapped in packages of convenient size, and securely bound by string. The wrapping consists of two or three thicknesses of coarse cheese cloth or some similar open or porous material. The packages are then used in place of loose carbide in acetylene generators.—J. A. B.

Acetylene Generators. E. Hilberg, Berlin. Eng. Pat. 16,426, August 12, 1899.

Carbide is contained above a funnel-shaped partition in a chamber of which the lower open-ended portion is immersed in water. The mouth of the funnel is controlled by a valve consisting of two flaps of india-rubber. These flaps are pushed apart, and carbide is discharged into the water, by means of a rod, which may be operated either by hand or automatically. The chamber is surrounded by an annular space up which the water, displaced from the chamber by the gas evolved, is forced. The annular space may be provided with a spiral course, which will prevent the escape of gas in the event of the apparatus being overturned. The flaps of the valve may be modified so that there is formed between their adjacent edges a cavity capable of containing a suitable charge of carbide, and the actuating rod then first allows the cavity to receive a charge, and afterwards discharges the contents of the cavity into the water. The object of this modification is to prevent the discharge of uneven quantities of carbide.—J. A. B.

Filaments or the like for Incandescence or Glow Electric Lamps. H. Hirst, London. Eng. Pat. 24,265, Nov. 17, 1898.

This relates to filaments which are non-conductors whilst cold, but become sufficiently conductive when heated by means of some auxiliary arrangement. The claims are for the production of filaments by impregnating cores of cotton, horse hair, &c., with a saturated solution of salts of magnesium, zirconium, yttrium, thorium, &c., then drying, and raising the threads to a high temperature. The filaments may be repeatedly treated with the solution. The impregnated cores may be treated with ammonia gas before drying and heating. Instead of using soluble salts, the oxides or insoluble salts may be ground with water containing "a glutinous material," and the organic base may be dipped into the cream thus formed.—H. B.

Incandescent Spirit Lamps. K. Lehmann, Wilmersdorf, Germany. Eng. Pat. 12,780, June 19, 1899.

In a circular-wick lamp, burning spirit, the burner-top is provided with a double-walled casing which is contracted somewhat, a short distance above the top of the wick so as to direct the flame into the central air current. An external air supply passes through perforations in the outer wall of the casing, one stream passing up between the mantle and chimney, the other passing down to the foot of the inner wall of the casing and so up to the outer edge of the wick.
—H. B.

Incandescence Oil Lamps. O. Imray, London. From F. E. Mavrogordato, Constantinople. Eng. Pat. 13,249, June 26, 1899.

The oil is led up a coiled tube which is heated continuously by the flame of an auxiliary burner, and the vapours pass through a receiver and a central cup-shaped body which is kept at a high temperature by the auxiliary flame. The gas then enters a second receiver, passing thence by a jet into a Bunsen burner furnished with a mantle as usual.
—H. B.

Oxygen Gas Generators. W. Riley, Bradford, and A. Kershaw, Leeds. Eng. Pat. 24,885, Nov. 25, 1898.

The generator is a long cylindrical retort, supported horizontally on standards constructed to fold down, and placed at each end of a slide supporting a carriage carrying the burner. Cartridges containing the oxygen-producing mixture are placed at definite intervals in the retort. The burner is brought under one end of the retort at first, and as the gas is disengaged, it is led to a washing vessel below, and to a gas-holder, the rising of which automatically operates a device which passes the burner on its travelling carriage, so that it shall come under the next cartridge in the retort, and so on successively. "The gas-holder may be contained in a box having a divided lid, the halves of which may be arranged to turn up and support the slide or guide, and also act as guides for the container."—E. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

Acetone Oils. R. Duchemin. Bull. Soc. Chim. **21**, [16—17], 798—800. (See Buisine, this Journal, 1899, 405 and 484.)

Examination of several samples of acetone oils proves that they are very variable in composition. Far from being, as Buisine suggests, a regular source of methylpropylketones, they often contain only traces, while other samples may contain up to 50 per cent. of methylethylketone. These differences arise, first, from differences in the calcium "pyrolignites," from which they are prepared, and second, from the larger or smaller number of washings to which they have been subjected in extracting the acetone.
—J. T. D.

Petroleum Industry of Japan. Shiu-ichi Takano. Petr. ind. techn. Rev. **1**, [26], 475—476.

The principal oilfields are Echigo, Totomi, Ugo, and Shinano, the first named producing about 85 per cent. of the total output (1,600 barrels out of 2,000 per diem); but the general oil field extends for several hundred miles, the width ranging from 10 to 40 miles.

The crude oil from the different centres varies in quality: density: 14°—46° B.; colour, dark green to pitch black, the latter with unpleasant smell. Nagaoka and Amaze crude is 34°—41° B. in density, the former resembling Canadian or Lima crude, the latter being more like middle Pennsylvania crude, with a large percentage of burning oil and solid paraffin. The percentage yield is as follows :—

—	Amaze.	Nagaoka.
Petroleum spirit (benzine)	21·92	10
Burning oil..........................	49·80	50
Heavy oil	20·52	25
Residue and loss.....................	7·76	15

The figures refer to laboratory results in the first case, and refinery results in the other cases. The residuum is utilised for fuel.

The producing companies number 200 and the refineries 30; pipe lines, 3, with a fourth in prospect. Wells are drilled by the American and artesian methods, the greatest depths attained being 2,500 and 900 feet respectively; and shafts are also sunk to about 690 ft. Nearly all the wells spout at first, and yield from 2 to 20 barrels per diem; the rock is considered too soft and loose for torpedoing.

Within the past eight years the production of crude oil has risen from 55,000 barrels to 828,000 (= 331,200 barrels of refined oil) per annum, whilst the average monthly imports are 132,567 barrels, 70 per cent. being American, and the balance from Russia.—C. S.

Petroleum, The Intschik Method of Refining. S. J. Salomon. Trudy bak. otd. 1899, 1; Oesterr. Chem. u. Techn. Zeit. **17**, [19], 3—4.

The author's experiments on the effect of air, of different degrees of purity, in the usual air-blast agitators, show that by the use of purified air the amount of sulphuric acid required to refine petroleum distillates may be reduced to one-half the usual quantity in the case of burning oil, and to as little as one-third in the case of lubricating oils.

This he considers sufficiently proves the injurious action of the impurities present in ordinary air, and demonstrates the value of Intschik's proposal to employ either purified air or inert gases for the air-blast. The air to be purified is passed through the waste sulphuric acid from the acid process of refining in an apparatus resembling the scrubbers used in gasworks, or allowed to bubble through the said waste acid in a closed vessel, or through a series of vessels of the Woulfe's bottle type. The advantage of this purified air consists in the fact that the sulphuric acid in the refining agitator is enabled to confine its action to the oil alone, without being uselessly consumed in oxidising the atmospheric impurities, or suffering dilution from the moisture in the air-blast.

It is advisable to have the purifying apparatus mounted in connection with the suction pipe of the air-blast pump, stronger construction being necessary if connected with the delivery pipe. By making use of closed agitators the air or gas employed may be used over and over again, it being then only necessary to replace the small amount lost from unavoidable causes; in any event, however, the air, &c. should be passed through the purifier after each time of using.—C. S.

Hexamethylene, The Vapour Pressures, Specific Volumes, and Critical Constants of. S. Young and E. C. Fortey. Proc. Chem. Soc. **15**, [213], 182.

A specimen of hexamethylene obtained by fractional distillation from Galician petroleum was found to solidify, though not completely, in an ordinary freezing mixture. It was, therefore, still further purified by fractional crystallisation until the melting point rose to 4·7°. The density of the liquid at 0°—4° was 0·79675, b.p. 80·9°, at 760 mm.

Bitumens, Determinations of Sulphur in. S. F. and H. E. Peckham. J. Amer. Chem. Soc. 1899, [9], 772.

See under XXIII., *page* 1056.

Artificial Asphalt, Process for Producing. A. E. Alexander, London. From D. W. Peck, Syracuse, U.S.A. Eng. Pat. 24,629, Nov. 22, 1898.

See under IX., *page* 1021.

Artificial Asphalt, Producing. A. E. Alexander, London. From D. W. Peck, Syracuse, U.S.A. Eng. Pat. 24,630, Nov. 22, 1898.

See under IX., *page* 1021.

Naphtha, Determination of Sulphur in. A. Lidow. J. russ. phys.-Chem. Ges. **31**, 567. Chem. Centr. 1899, **2**, [9], 493.

See under XXIII., *page* 1056.

PATENTS.

Pyroligneous Spirit from Sawdust, Apparatus for Extracting. P. Schneider, Düsseldorf, Germany. Eng. Pat. 14,760, July 18, 1899.

The claims are for :—(1.) "An apparatus for extracting pyroligneous acid from sawdust, characterised by a revolving cylinder in the fixed walls of a furnace, and by agitators with inclined arms and in a helix arranged in said cylinder, and moving in an opposite direction to the movement of the latter"; (2.) "in an apparatus as claimed in (1), a box having a fan wheel, receiving the material to be treated through an upper channel, and feeding it into the rotating cylinder through another channel"; and (3.) "in an apparatus as claimed in (1) and (2), *viz.* a box, in which revolve in opposite directions two wheels with arms, which serve to forward towards the aforesaid upper channel the material through the feeding funnel."

The rotary motion of the cylinder ensures a uniform heating of its contents, which heating is rendered still more homogeneous by the action of the mixers. The continuity of the work guarantees an even yield, much superior to that obtained by other means.—D. B.

Free Carbon from Tar, and Apparatus for the Separation of. F. Lennard, London. Eng. Pat. 2183, Jan. 31, 1899.

The tar, from which the separation of carbon is to be effected, is diluted with an oil or spirit of such lower density as to produce a mixture having an appreciably lower boiling point than the tar alone has. The mixture is passed into a chamber, externally heated to the volatilising point of the former, wherein it is subjected to the action of steam, which has the effect of depriving the mixture of practically all its liquid portion, the free carbon being deposited in the form of a rough powder. The chamber, in which the mixture is so treated, is preferably of somewhat conical form, smaller at bottom than at top, and is provided with a distributor and a rotating scraper, and with means for admitting steam at the lower part, the bottom of the chamber being provided with a seal, to allow of the removal of the deposited carbon. The volatile products driven off from the chamber, can be condensed, the lighter oil or spirit being used for mixing with a further quantity of tar, and the remainder being conducted (if desired through an interchanger through which the lighter products pass) to a still, which can be heated by the hot gases from the furnace supplying heat to the chamber.—D. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Synthesis of Chrysin. T. Emilewicz, St. v. Kostanecki and J. Tambor. Ber. **32**, [13], 2448—2450.

Ethyl benzoate reacts with phloracetophenone in presence of metallic sodium forming 2·4·6-trimethoxybenzoylacetophenone—

$$2\cdot4\cdot6\cdot1\cdot C_6H_2(OCH_3)_3\cdot COCH_2COC_6H_5.$$

On boiling with hydriodic acid, the methyl groups are eliminated and condensation takes place, forming the yellow natural dyestuff Chrysin (1·3-dioxyflavone). The substance so obtained forms light yellow crystalline plates melting at 275° C., and in order to still further confirm its identity with the natural product (both Chrysin and Tectochrysin were isolated by Piccard from the buds of the poplar) it was converted into tectochrysin (1·3-oxymethoxyflavone) $C_{16}H_{12}O_4$ by heating on the water-bath with methyl alcoholic potash and methyl iodide. This compound crystallises from alcohol in yellow needles, melting at 163° C., and forms a characteristic intensely yellow sparingly soluble sodium salt.

See Berichte **6,** 884, 1100; **7,** 888, 1485; **10,** 176; and **26,** 2903 (this Journal, 1894, 509).—T. A. L.

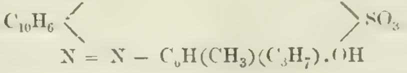
Thymol Parasulphonic Acid, Action of Diazo Compounds upon. J. H. Stebbins, jun. J. Amer. Chem. Soc. 1899, **21,** [9], 741—745.

In a former paper (J. Amer. Chem. Soc. **3,** 112) the author described several azo compounds obtained by combining diazo compounds of the benzene series with thymolparasulphonic acid. He now finds that the union of diazo compounds of the naphthalene series with that acid produces brownish to crimson colouring matters. Thus, when a solution of diazo-naphthionic acid is run into a cooled solution of thymol parasulphonic acid water rendered alkaline with sodium hydroxide, the mixture at first turns bright red, and then gradually increases in colour as the diazo solution is run in, until finally it assumes a deep reddish-brown colour with a shade of crimson.

When the solution is allowed to stand overnight, and is then heated to the boiling point, and saturated with dry sodium chloride, a reddish-brown precipitate is thrown down, whilst the filtrate contains a crimson-red dye, which is so soluble that it can only be precipitated to a small extent by boiling the liquid with a large excess of sodium chloride. It may, however, be precipitated as a barium salt, but the yield of the salt obtained by the authors was insufficient for examination.

The brown precipitate, when dissolved in water and treated with an excess of barium chloride, yields a yellow coloured barium salt, whilst the filtrate from this contains a purplish-red dyestuff, apparently identical with that obtained in the first filtrate. From this the authors infer that two dyestuffs are produced by the action of diazo naphthionic acid on thymol parasulphonic acid, but as the more soluble crimson one is present only in very small quantity, they consider that it is possibly derived from the presence of a small quantity of thymol disulphonic acid as an impurity.

The yellow barium salt is fairly soluble in water whilst moist, but its solubility is greatly diminished on drying. It can be obtained in fine crystalline orange needles by dissolving it in water and allowing the solution to cool slowly. From the results of their analysis, the author considers that its formula is probably—

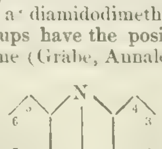


$$\begin{array}{l} \qquad SO_3 \text{————————} Ba \\ C_{10}H_6 \langle \qquad\qquad\qquad\qquad \rangle SO_3 \\ \qquad N = N - C_6H(CH_3)(C_3H_7).OH \end{array}$$

A reddish-brown colouring matter is also obtained by the combination of diazo-β-naphthalene sulphonic acid with sodium thymol parasulphonate.—C. A. M.

Benzoflavines. R. Meyer and R. Gross. Ber. **32,** [13], 2352—2371.

The authors have investigated commercial benzoflavine, and summarise their results as follows:—They confirm the formula for the base $C_{21}H_{19}N_3$, and have obtained from it dimethylphenylacridine, and since this latter can be synthesised from *p*-ditolylamine and benzoic acid, the base has the composition of a· diamidodimethylphenylacridine, in which the methyl groups have the positions 2:7, according to the following scheme (Gräbe, Annalen **276,** 39):—



The amido groups probably have the positions 3 and 6, although the positions 1:8 and 3:8 are not altogether excluded. The benzoflavines are isomeric with the chrysanilines, differing in the positions of the amido groups. This isomerism has an important bearing on the fluorescent phenomena exhibited, the benzoflavines in their solutions fluorescing much more strongly than the chrysanilines. The authors have also investigated an analogously constituted substance obtained by the action of ammonia on fluoresceïn. This has the formula $C_{20}H_{15}N_3O_2$, and can be alkylated. On eliminating two amido groups, it forms acridyl benzoic acid, which is a further proof that the substance itself is a diamido-acridyl benzoic acid.

—T. A. L.

Isomeric Xylidines, Method of Separating from the Commercial Product. W. R. Hodgkinson and L. Limpach. Proc. Chem. Soc. **15,** [213], 202.

This method depends on the fact that acetate of metaxylidine ($CH_3:CH_3:NH_2 = 1:3:4$) crystallises very readily when the crude mixture is treated with acetic acid. From the filtrate from this acetate, hydrogen chloride precipitates the para-($CH_3:NH_2:CH_3 = 1:2:4$)-xylidine as hydrochloride, and the filtrate from this, on concentration and heating, yields up the hydrochloride of the ($CH_3:NH_2:CH_3 = 1:2:3$)-xylidine as a crystalline sublimate. The residue of hydrochlorides of the two ortho-($CH_3:CH_3:NH_2 = 1:2:3$ and $CH_3:CH_3:NH_2 = 1:2:4$)-xylidines is hydrolysed and the bases converted into formyl derivatives; that from the ($CH_3:CH_3:NH_2 = 1:2:3$)-base crystallises moderately easily, whilst the other from the ($CH_3:CH_3:NH_2 = 1:2:4$) base is exceedingly difficult to obtain as a solid.

Diphenylmethylene-aniline, Preparation of. E. Nägeli. Bull. Soc. Chim. **21,** [16—17], 785—786.

Benzophenone (3·5 parts), dry aniline (7 parts), and powdered fused sodium sulphate (1 part), are boiled with a reflux condenser for 18—20 hours; the liquid, decanted from the sodium sulphate, is then fractionally distilled, when the major portion comes over at 356°—358° C., and on redistillation furnishes pure diphenylmethylene-aniline (about 70 per cent. of the theoretical amount). The object of the sodium sulphate is to absorb the water formed.

—J. T. D.

Nitration of Naphthalene at High Temperatures. E. Nägeli. Bull. Soc. Chim. **21,** [16—17], 786—787.

The sulphonation of naphthalene yields the α- or β-derivative according as it is carried out at 70°—80° C., or at 160°—170° C. The nitration of naphthalene yields always the α-derivative. By acting on naphthalene with potassium nitrate and the acid sulphate of potassium or of sodium (which allows the nitration to go on at temperatures of 200° and 300° C. respectively), the author hoped to prepare the β-derivative. In this he was unsuccessful, the α-derivative alone being obtained; but he draws attention to the method as one that may be of use in special cases.—J. T. D.

Condensation of Diphenylcarbinols with Paraquinones and Paraquinonoid Compounds. R. Möhlau and V. Klopfer. Ber. **32,** [13], 2146—2159.

A preliminary communication on this subject has already appeared (Ber. **31,** 2351; this Journal, 1899, 35). The authors now find on further investigating the condensation of aromatic alcohols with quinones and quinonoid compounds, that the alcoholic hydroxyl group only reacts with a hydrogen in the quinone nucleus when the alcohol is a secondary aromatic one, such as diphenylcarbinol or tetramethyldiamidodiphenyl carbinol, and the quinone is a *p*-quinone or a compound derived therefrom. The condensation takes place between equal molecular proportions (except in the case of benzoquinone) at the temperature of the water-bath, in absolute alcohol or in glacial acetic acid, in the latter case in presence of some sulphuric acid. The condensation products are generally well crystallised coloured compounds which retain their quinonoid character in so far that reducing agents convert them into the corresponding hydroquinone or leuco derivatives. They do not, however, react with phenols, amines, and hydrazines like the original substances. Moreover, the quinonoid derivatives of the alkylated amidodiphenylcarbinols corresponding to the triphenylmethane leuco bases are converted on oxidation into new dyestuffs containing two different chromophors. The following compounds have been prepared: *Benzo-*

quinonebidiphenylmethane, $C_6H_2O_2[CH(C_6H_5)_2]_2$.—A solution of 10·8 grms. of quinone and 18·4 grms. of diphenylcarbinol in 150 grms. of glacial acetic acid and 1 c.c. of sulphuric acid (1 : 19) is heated for 12 hours on the water-bath. The condensation product crystallises from absolute alcohol in long yellow prisms, which soften at 238° C., and are completely melted at 250° C. On reduction with stannous chloride it forms the corresponding hydroquinone, which separates from ether in colourless crystals melting at 241° C. Benzoquinone also condenses in an alcoholic solution with two molecular proportions of tetramethyldiamidodiphenylcarbinol to form a colourless product, melting at 245° C. Its solution, in dilute acids, is coloured bluish-green by potassium permanganate or lead peroxide. The condensation of equimolecular proportions of diphenylcarbinol and α naphthoquinone only takes place in acetic acid solution in presence of sulphuric acid. The product obtained in nearly theoretical yield, crystallises from absolute alcohol in shining, needle-shaped prisms, melting at 185° C. The hydro compound could only be obtained as a vitreous mass. With tetramethyldiamidodiphenylcarbinol, α-naphthoquinone condenses in alcoholic solution, yielding shining, violet-red plates, which soften at 132° C. and melt completely at 152° C. This substance, α-naphthoquinonetetramethyldiamidodiphenylmethane, in addition to containing a chromophor, and therefore being coloured, is also the leuco base of a diphenylnaphthylmethane dyestuff, into which it can be converted by oxidation with lead peroxide. This dyestuff, in the form of its zinc chloride double salt, is a dark blue, crystalline powder, which dyes a greenish blue shade. Naphthazarin condenses with diphenylcarbinol in alcoholic solution in presence of some sulphuric acid to form red needles, which melt at 196° C. The reduction product obtained with stannous chloride forms light yellow prismatic needles, melting at 208° C. The condensation product of naphthazarin and tetramethyldiamidodiphenylcarbinol separates from alcohol in violet crystals, melting at 183° C. The authors find that diphenylcarbinol will not condense with *p*-nitrosophenol, whilst tetramethyldiamidodiphenylcarbinol readily combines in an alcoholic solution to form yellow prisms, melting at 217° C. Nitrosodimethylaniline hydrochloride does not react with diphenylcarbinol, but the base treated in alcoholic solution with the carbinol, yields dark yellow prisms of tetramethyldiamidoazoxybenzene, melting at 239° C. The reaction between *p*-nitrosodimethylaniline and tetramethyldiamidodiphenylcarbinol proceeds normally in an alcoholic solution forming yellow, needle-shaped prisms of the methane derivative, melting at 212° C. On reduction with stannous chloride, this product forms hexamethyltetramidotriphenylmethane, which crystallises from ether in shining prisms, melting at 171° C. The authors also describe condensation products they have obtained from diphenylcarbinols and certain quinoneimide dyestuffs, such as Meldola's Blue, Muscarin, and Gallocyanin. They find that those dyestuffs react especially readily which contain an easily substituted hydrogen atom in one of the rings para to the chromophoric nitrogen. But also quinoneimide dyestuffs substituted in both rings para to the nitrogen, like the oxazines, Gallocyanin, and Prune, can take up a carbinol radicle, whereas indamines and indophenols will not condense. The hydrochloride of Meldola's Blue and tetramethyldiamidodiphenylcarbinol condense in alcoholic solution in equimolecular proportions, and the product, on oxidation, in a faintly acid solution, with lead peroxide, yields a new dyestuff, which does not differ greatly in shade from the condensation product. Similar products are described from Muscarin and Gallocyanin.—T. A. L.

Tannin with Phenylhydrazine, Condensation of. A. Pellizza. Rev. Gén. des Mat. Col. 1899, **3**, [34], 349—350.

Böttinger (this Journal, 1888, 517) studied the reaction of Fischer's reagent (phenylhydrazine hydrochloride and sodium acetate) on tannin, and found that an intense yellow coloration was produced which some time afterwards was followed by the separation of a brownish-yellow mass. Schiff's α-digallic acid did not give the same reaction, and Böttinger attributed the coloration to an impurity in the tannin. Since then, Walden has shown that α-digallic acid and tannin are not identical.

On heating together for an hour 10 parts of pure commercial tannin and 5 parts of phenylhydrazine acetate dissolved in 15 parts of 50 per cent. acetic acid, a highly coloured liquid is obtained. When this is poured into cold water a brick red precipitate is formed which is rapidly transformed into a resinous mass. From alcoholic solution the substance is precipitated as a powder by ether. It is soluble in many organic liquids and in sodium carbonate, to a brown solution. It has the properties of an azo compound, and a nitrogen determination agrees with the formula $C_{10}H_8O_7(C_6H_5N_2)_2$.

In suspension in dilute acetic acid it can be dyed brick red and brown shades on the following mordants : Fe, Al, Sn, Bi, Th, Ti, Y, Zr. The resistance of the lakes formed is satisfactory towards light, soap, and acids.

The fabric can also be dyed directly with it by printing with a mixture of tannin and phenylhydrazine acetate or phenylhydrazine sodium sulphonate and developing the colour with steam.—J. McC.

Dibenzyl Ketone, Action of Light and of Oxygen on. E. C. Fortey. Proc. Chem. Soc. **15**, [213], 182.

When dibenzyl ketone is exposed to air in presence of sunlight, partial decomposition takes place with formation of benzaldehyde, benzoic acid, and phenylacetic acid. After prolonged exposure of a sealed tube containing the ketone with oxygen, another reaction was found to have taken place, carbon monoxide and toluene being produced, together with a substance melting at 193°—194°, and having a composition corresponding with the formula $C_{15}H_{13}O$. These products were also formed when dibenzyl ketone was exposed in vacuous tubes, or tubes filled with carbon dioxide.

Induline Dyestuffs, Electrolytic Preparation of. E. C. Szarvasy. Proc. Chem. Soc. **15**, [213], 194.

When a mixture of aniline hydrochloride and aniline is fused and electrolysed under given conditions, induline colouring matters are formed. The author describes the apparatus he constructed to carry out these experiments. The following products were separated :—

Induline, $C_{18}H_{13}N_3$; B4, Anilido-induline, $C_{24}H_{18}N_4$; Induline 6B, $C_{30}H_{23}N_5$; and Azophenine, $C_{36}H_{29}N_5$.

The results prove (1) that the chlorine produced by the electrolytic decomposition of the aniline hydrochloride effects azotisation, (2) that under certain conditions the azo compounds thus formed, react with the hydrochloride of aniline, forming (3) primarily azophenine, (4) ultimately indulines.

Benzidine and Tolidine, Colour Reaction for the Recognition of. J. Wolff. Ann. Chim. anal. appl. **4**, 263 ; Chem. Centr. 1899, **2**, [11], 569.

See under XXIII., *page* 1054.

Quinones derived from Benzene, Volumetric Determination of. A. Valeur. Comptes Rend. **129**, [15], 552.

See under XXIII., *page* 1056.

PATENTS.

Polyazo Dyestuffs [Green to Greenish-Black], Manufacture of New. G. W. Johnson, London. From Kalle & Co., Biebrich-on-the-Rhine, Germany. Eng. Pat. 23,893, Nov. 12, 1898.

The diazo compounds of salicylic acid and of its homologues and analogues, in which the carboxyl and hydroxyl groups are present in the ortho position relatively to each other, cannot be made to combine directly with amidonaphthol disulphonic acids. The patentees find that they combine with α-naphthylamine and with 1:3′- and 1:2′-naphthylamine sulphonic acids forming compounds which, when diazotised, readily combine with the disulphonic acids in question. Valuable dyestuffs are obtained by further acting upon the disazo compounds thus prepared, with diazotised aniline, α-naphthylamine, &c., or by substituting for the disulphonic acids in the above reaction the amido-azo compounds which are formed by coupling them with diazotised aniline, &c. They dissolve in concentrated sulphuric acid to blue or greenish-blue solutions, and dye wool from an acid bath, green to greenish-black shades. Their fastness is considerably increased by subsequently mordanting them by treatment with a chromium salt.

A green dyestuff is obtained by diazotising the amido-azo compound prepared from 15·5 kilos. of amido-salicylic acid and 14·5 kilos. of α-naphthylamine, with 7 kilos. of sodium nitrite and an excess of hydrochloric acid, and combining the resulting product with the *o*-amido-azo compound which is formed from 9·3 kilos. of aniline and 34·1 kilos. of amidonaphtholdisulphonic acid K. It is salted out, filter-pressed, and dried as usual.—E. B.

Paradiamidodiphenylamine Carboxylic Acid, and of Colouring Matters [Azo Dyestuffs for Cotton] therefrom, The Manufacture or Preparation of. G. W. Johnson, London. From Kalle and Co., Biebrich-on-the-Rhine, Germany. Eng. Pat. 25,964, Dec. 8, 1898.

CARBOXY derivatives of diphenylamine have not hitherto received any technical application. A *p*-diamidodiphenylamine carboxylic acid which yields valuable azo derivatives is, according to this invention, conveniently prepared by reducing the corresponding nitro compound, obtained by heating together for 5 hours, 45 kilos. of sodium chloronitrobenzoate ($Cl : NO_2 : COOH = 1 : 4 : 6$), 22 kilos. of *p*-phenylenediamine, 12 kilos. of sodium carbonate, and 500 litres of water. On cooling the solution, the sodium salt of the nitro-compound crystallises out: the free acid is obtained by acidifying a hot solution of it. The reduction is effected by treating 50 kilos. of the free nitro-carboxylic acid so obtained, with the same amount of iron filings, 3,000 litres of water, and 5 litres of acetic acid. When it is completed, sodium carbonate is added until the liquid is alkaline, and the solution is filtered. The filtrate is then treated with hydrochloric acid, which at first precipitates the diamido-carboxylic acid, but afterwards redissolves it as the hydrochloride and finally, on further addition, precipitates it in this form.

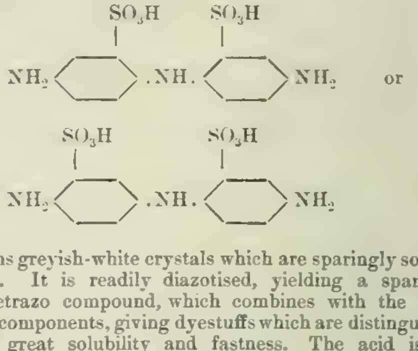
p-Diamidodiphenylamine carboxylic acid is tolerably easily soluble in hot water, from which it crystallises in small needles. It forms stable salts with mineral acids: of these the hydrochloride is readily, the sulphate sparingly, soluble. When it is acted upon with nitrous acid, it gives an easily soluble tetrazo compound, but a diazo compound may also be obtained. The disazo dyestuffs prepared from the former of these, are especially valuable "because in clearness and purity of tone, as well as in strength of colour, they surpass the analogous colouring matters from other paradiamines." The following examples illustrate their preparation:—31·6 kilos. of the hydrochloride of *p*-diamidodiphenylamine carboxylic acid are dissolved in 500 litres of ice water and diazotised by the addition of 30 kilos. of hydrochloric acid and 14 kilos. of sodium nitrite. The solution is run into a cooled, aqueous solution of 50 kilos. of sodium 1:4 naphthol sulphonate, and 40 kilos. of sodium carbonate. A red-violet intermediate compound is formed and is converted into a blue disazo dyestuff after 12 hours' agitation. The solution is thereupon heated and the dyestuff salted out. It dyes unmordanted cotton blue from a bath containing common salt. By employing naphthionic acid in place of the naphthol sulphonic acid in the preceding example, a red dyestuff is obtained. Similarly, with amidonaphthol disulphonic acid K, a pure blue, and with acid H, a greenish-blue dyestuff is produced. With 1 molecular proportion of 1:4 naphthol sulphonic acid and 1 molecular proportion of amidonaphthol disulphonic acid H, a blue dyestuff is formed. A dyestuff which colours cotton black is obtained by combining tetrazotised *p*-diamidodiphenylamine carboxylic acid with 1 molecular proportion of amidonaphthol sulphonic acid G, diazotising the product, adding to the sparingly soluble tetrazo compound thus formed, a solution of 2 molecular proportions of *m*-tolylenediamine and then rendering the mixture feebly alkaline with sodium carbonate. Dyestuffs are also produced by taking equal molecular proportions of different dyestuff components in place of the two molecular proportions of *m*-tolylenediamine in the last example: thus, 1 molecular proportion of amidonaphthol sulphonic acid G, and 1 molecular proportion of β-hydroxynaphthoic acid, with which a blue-black dyestuff is obtained. —E. B.

Diamidodiphenylamine Disulphonic Acid and Azo Dyestuffs therefrom, Manufacture of. O. Imray. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst-a.-Main, Germany. Eng. Pat. 24,286, Nov. 17, 1898.

p-Nitrochlorobenzene sulphonic acid—

$$(NO_2 : Cl : SO_3H = 1 : 4 : 3)$$

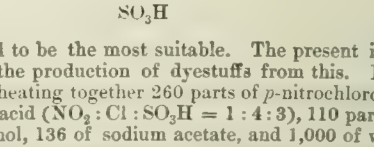
reacts with sulphonic acids of aromatic diamines, forming hydrochloric acid and nitroamido derivatives of dialphylamine disulphonic acids, which, on reduction, yield the corresponding diamido derivatives. As an example, 200 kilos. of *p*-nitrochlorobenzene sulphonic acid, 150 kilos. of *p*-phenylenediamine sulphonic acid, 100 kilos. of soda and 1,000 kilos. of water, are cohobated together for 6 hours. The solution thus obtained is acidified with hydrochloric acid, giving a precipitate which is filter-pressed and then reduced with iron and acetic acid. The product is isolated by rendering the solution alkaline with caustic soda, filtering, and precipitating with an excess of hydrochloric acid in the presence of which it is insoluble. It has the constitution:—



It forms greyish-white crystals which are sparingly soluble in water. It is readily diazotised, yielding a sparingly soluble tetrazo compound, which combines with the usual dyestuff-components, giving dyestuffs which are distinguished by their great solubility and fastness. The acid is, for instance, diazotised and combined with 2 molecular proportions of amidonaphthol disulphonic acid G, forming a violet dyestuff, which is in turn diazotised and combined with 2 molecular proportions of *m*-phenylenediamine. The product dyes, from an alkaline bath unmordanted cotton black. By diazotising the acid and combining with 2 molecular proportions of *m*-phenylenediamine, a dyestuff is obtained which dyes cotton red, and when this is treated on the fibre with "diazonitrobenzene," a very fast dark brown is produced.—E. B.

Blue and Black Sulphurised Dyestuffs, Manufacture of. O. Imray, London. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst-a.-Main, Germany. Eng. Pat. 24,538, Nov. 21, 1898.

DYESTUFFS which dye unmordanted cotton blue, are obtained by heating para-substituted diphenylamine sulphonic acids with sulphur and alkali sulphides at 200° C. Of all the acids tried in this connection by the patentees, *p*-hydroxy-*p*-amidodiphenylamine *o*-sulphonic acid—



has proved to be the most suitable. The present invention relates to the production of dyestuffs from this. It is prepared by heating together 260 parts of *p*-nitrochlorobenzene sulphonic acid ($NO_2 : Cl : SO_3H = 1 : 4 : 3$), 110 parts of *p*-amidophenol, 136 of sodium acetate, and 1,000 of water for 6—8 hours on the water-bath. *p*-Hydroxy-*p*-nitrodiphenylamine sulphonic acid is thus produced. Without separating it, it is reduced, best by means of iron and acetic acid. The *p*-hydroxy-*p*-amido product is then separated by rendering the solution alkaline, filtering off the iron mud, and acidifying with hydrochloric acid. It is thus obtained as a crystalline mass, which is sparingly soluble in water. In order to prepare a blue dyestuff, 30 parts of this are added to a fused mixture of 100 parts of sodium sulphide and 40 parts of sulphur, and the whole is heated at 160°—200° C., until the mass, after evolving hydrogen sulphide, becomes solid. On cooling, a dark porous mass is obtained, dissolving readily in water and dyeing cotton a pale green, which changes to blue when the cotton is dried and exposed to the air, or is treated with an oxidising agent, owing to the fact that the dyestuff is present in the crude product in the form of a leuco compound. To convert this into the dyestuff the crude product is dissolved and treated with an oxidising agent, *e.g.*, hydrogen peroxide, or better, with a blast of air. The solution is then filtered from the excess of sulphur and the dyestuff salted out. In the dry state it forms a dark brown powder with a coppery lustre, easily soluble in water to a blue solution, and precipitated from this solution by acids.

If the mass obtained as above described at 160°—200° C. be heated for three hours longer at a higher temperature, namely at 200°—240° C., a further evolution of gas takes place, and a black porous mass is produced which dissolves in water with a dark grey colour, and dyes unmordanted cotton black.

p-Hydroxy-*p*-nitrodiphenylamine sulphonic acid may be employed in place of *p*-hydroxy-*p*-amidodiphenylamine sulphonic acid in the above reaction.—E. B.

Dyestuffs [*Blue*], *for Cotton; The Manufacture or Production of.* H. E. Newton, London. From The Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 24,383, Nov. 18, 1898.

According to Eng. Pat. 17,018 of 1897 (this Journal, 1898, 754), dyestuffs are produced from 1.1′-amidonaphthol and 1.1′-dihydroxynaphthalene or their sulphonic acids by heating them with sulphur and alkaline sulphides, and separating the products obtained by their difference in solubility in water. Of these, the more soluble products dye cotton from baths containing reducing substances, such as glucose and alkali sulphides, brown shades which change into blue on the cotton being exposed to the air, while the less soluble compounds dye brown shades which remain unchanged. The patentees now find that the formation of these brown products is practically avoided by the employment of zinc or zinc compounds in the fusion process, and that dyestuffs are obtained which directly yield on cotton blue shades fast to alkalis and to light. Dyestuffs are thus obtained from the compounds mentioned above, 1.1′-chloronaphthol sulphonic acids, and the dyestuffs formed from 1.1′-amidonaphthol sulphonic acids and diazo compounds. As an example of the process of manufacture:—20 parts of dry powdered zinc chloride are stirred into a solution prepared from 132 parts of a 38 per cent. paste of 1.1′-amidonaphthol 3:4-disulphonic acid and 60 parts of soda-lye (30 per cent. of NaOH). After the addition of 87 parts of dry sodium sulphide and 82 parts of flowers of sulphur, the mixture is gradually heated to 200° C., and kept at this temperature until it solidifies. When this takes place, the vessel containing the mixture is closed, and the temperature is raised to 240° C., at which temperature the mass is kept for four hours. A blue-black powdery mass is thus obtained, which can be directly used in dyeing. It yields on cotton from boiling baths containing common salt, Indigo blue shades fast to alkalis and light.
—E. B.

Colouring Matters of the Naphthalene [*Naphthazarin*] *Series, Manufacture of New.* J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 24,752, Nov. 23, 1898.

The leuco compound of the intermediate product of the Naphthazarin melt, prepared according to Eng. Pat. 15,708 of 1898 (this Journal, 1899, 679), gives, on treatment with fuming sulphuric acid, a pure blue dyestuff from which other valuable dyestuffs are obtained, namely, a sulphonic acid of Naphthazarin, and new green and blue dyestuffs.

In order to prepare the first of these, 10 parts of the leuco compound of the intermediate product are heated with 100 parts of fuming sulphuric acid (23 per cent. of SO_3) at 100° C. for two hours. The mixture is cooled and poured on to 2,000 parts of ice, and the dyestuff is salted out. It is thus obtained in the form of dark blue needles. It yields a blue solution in water and a yellow solution in concentrated sulphuric acid. It dissolves in a dilute solution of caustic soda with a blue colour, but is precipitated by an excess of the reagent. When heated in dilute sulphuric acid its colour changes to red. It can be reduced with tin and hydrochloric acid or with sodium hydrosulphite, and may be employed in this form in dyeing, giving the same shades as the unreduced dyestuff. It dyes both mordanted and unmordanted wool very pure blue shades.

The dyestuff formed according to the above process is converted into a sulphonic acid of Naphthazarin by boiling 10 parts of it with 500 parts of water, and 10 parts of hydrochloric acid (32 per cent. of HCl) for half an hour. The product is precipitated with potassium chloride. It forms small needles or a brown-red powder; dissolves in water to a red solution, to a blue solution in aqueous caustic soda, and to a violet-red solution in concentrated sulphuric acid. It dyes unmordanted wool from an acid bath brown-red shades, which are converted into deep black on treatment with sodium bichromate. The shades thus obtained are characterised by great fastness.

The dyestuff produced according to the first example, again, is transformed into a green dyestuff when it is heated with an aromatic amine, either alone or in admixture with a salt of the same. 10 parts of it are, for example, boiled for an hour with 100 parts of aniline and 40 parts of aniline hydrochloride. The melt is poured into 2,000 parts of water, and 500 parts of hydrochloric acid (32 per cent. of HCl) are added. The precipitated dyestuff is filtered off and dried. It is insoluble in water but dissolves in benzene, alcohol, &c. It is sulphonated by heating it at 30°—40° C. for 24 hours with about 20 times its weight of concentrated sulphuric acid (95 per cent of H_2SO_4). The sulphonic acid thus obtained forms a blackish powder, which gives a green solution in water, and aqueous caustic soda, and a brown-red solution in concentrated sulphuric acid. It dyes unmordanted wool from an acid bath a fast green.

Further, a blue dyestuff is obtained from the dyestuff prepared according to the first example, when the latter is treated in a boiling aqueous solution with a salt of an aromatic amine; thus, 10 parts of the dyestuff and 20 parts of aniline hydrochloride are boiled for two hours in 500 parts of water. On cooling, the new dyestuff crystallises out in needles. It is sparingly soluble in cold water, but dissolves in hot water to a pure blue solution. In concentrated sulphuric acid it yields a violet, and in aqueous caustic soda a blue solution. It dyes unmordanted wool from an acid bath a blue which possesses a considerable degree of fastness to light.—E. B.

Mordant Dyeing Colouring Matters [*from Dinitroanthraquinone*], *Manufacture of.* J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 25,651, Dec. 5, 1898.

The comparatively soluble dyestuffs obtained as described in Eng. Pat. 16,495 of 1897 (this Journal, 1898, 753), are converted by treatment with concentrated sulphuric acid into comparatively insoluble dyestuffs of redder shades. For example, a dyestuff melt, prepared according to example 2 given in the specification referred to, with the use of sulphuric acid containing 45 per cent. of free SO_3, after being allowed to cool, is mixed with 5—6 times its weight of sulphuric acid containing about 63 per cent. of H_2SO_4. The mixture is heated for 1—2 hours at 130°—140° C. The dyestuff so formed is separated and collected in the usual way. It differs from the compound from which it is prepared in that it gives a red-violet solution in concentrated sulphuric acid, and that it dyes cotton, which has been mordanted with alumina, reddish shades, while the compound from which it is obtained dyes the same mordant blue-violet shades.—E. B.

Azo Colouring Matters [*Brown*] ***Manufacture and Production of.*** J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 211, Jan. 4, 1899.

o-Nitro-*o*-amidophenol *p*-sulphonic acid and *p*-nitro-*o*-amidophenol *o*-sulphonic acid, when they are diazotised and combined with *m*-phenylenediamine, give compounds dyeing wool from an acid bath brown shades, which are converted by chroming into dark browns or brownish blacks. The shades so obtained are as fast as those obtained from the Alizarin dyestuffs. "They resist milling, washing, rubbing, the action of sulphurous acid and of steam, and of carbonising, and possess an extraordinary fastness to the action of light." The following is an example of their preparation:—117 parts of *o*-nitro-*o*-amidophenol *p*-sulphonic acid are dissolved in 500 parts of water and 115 parts of soda-lye (35 per cent. of NaOH), 34½ parts of sodium nitrite dissolved in water are added, and the whole is then run into 500 parts of water and 220 parts of hydrochloric acid (30 per cent. of HCl). When the nitrous acid has disappeared, the solution is run into a solution of 95 parts of *m*-phenylenediamine and 300 parts of sodium acetate in 1,000 parts of water. The combination is usually finished in four hours. The dyestuff separates out completely, and is filter-pressed and dried.

The dyestuff from *o*-nitro-*o*-amidophenol *p*-sulphonic acid is a reddish-brown powder, which dissolves in water with a Bordeaux-red, in dilute caustic soda solution with a red, and in concentrated sulphuric acid with a red colour, its isomeride dissolving in the same solvents respectively with a brown, an orange-brown, and a red-brown colour. —E. B.

Colouring Matters [*Black*], *Manufacture of.* H. R. Vidal, Paris, France. Eng. Pat. 26,167, Dec. 10, 1898.

The dyestuffs formed according to the method described in Eng. Pat. 19,880 of 1893 (this Journal, 1894, 941) are, the patentee now finds, more readily produced from benzene-azo-*o*- and *m*- cresols by heating these in the same way with sulphur and alkalis or alkali sulphides. As an illustration of the process, the following example is given:—30 kilos. of benzene-azo-*o*-cresol, 40 kilos. of soda, and 8 kilos. of sulphur are heated gradually, first to 180° C., and, after the aniline which is produced has been removed by distillation, then to 240° C. for 6—8 hours. The product so obtained, a brittle black mass, is dissolved in water and treated with an acid, giving a precipitate of the dyestuff. This is dissolved by alkali sulphides to a dark brown, and by alkali bisulphites to a dark yellow solution. The former solution is suitable for dyeing vegetable fibres, the latter animal fibres. Both give black colours, dye more uniformly than the compounds previously obtained, and do not, like the latter, require, for their fixation, to be oxidised upon the fibre.

The dyestuff prepared as above described, dissolves in water to a blue-black, that obtained from benzene-azo-*m*-cresol dissolving to a yellowish-grey solution. The dyestuffs prepared according to Eng. Pats. 23,578 of 1893 (this Journal, 1894, 725) and 9443 of 1894 (this Journal, 1895, 477), give dull green solutions, and impart the same colour to vegetable fibres. They become black only when subjected to oxidation upon the fibre.—E. B.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Oxycellulose, Investigations on. O. v. Faber and B. Tollens. Ber. 1899, **32**, [14], 2589—2601.

The authors prepared "oxycellulose" in three different ways:—(1) By treatment of wood with nitric acid; (2) by the action of bromine and calcium carbonate upon cotton; and (3) by the action of nitric acid on cotton, according to Cross and Bevan. Amongst the soluble by-products of the oxidation, saccharic acid was recognised and isolated in method (2), and tartaric and other C_4 and C_5 acids in method (3).

The oxycellulose preparations were decomposed on boiling with lime and water, yielding an insoluble residue of true cellulose and dark yellow solutions, from which salts of iso-saccharic acid and dihydroxybutyric acid were isolated.

The authors conclude that the oxycelluloses prepared by the three different methods are identical in qualitative composition, but vary quantitatively, according to the manner and extent of the oxidation. They regard these preparations as mixtures—or, more probably, as chemical combinations—of cellulose with a more highly oxygenated body, which they term Celloxin, $C_6H_{10}O_6$ or $C_6H_8O_6$, and which is the true oxycellulose not yet isolated. In the preparations made by the authors, one celloxin group was present with from 1 to 4 cellulose, $C_6H_{10}O_5$, groups.—J. F. B.

Wool, The Chemical Nature of the Action of Nitrous Acid on. V. Flick. Bull. Soc. Ind. Mulhouse, 1899, 221.

See under VI., *page* 1015.

Report on the Preceding. E. Grandmougin and H. Bourry. *Ibid.*, 1899, 227.

See under VI., *page* 1016.

Dry-Cleaning, Process of. Dyers' Bulletin; through J. Soc. Arts, 1899, **47**, [2443], 812—813.

A WELL-EQUIPPED workroom is furnished with five cylindrical vessels of zinc, copper, or stone-ware with tight covers. The articles to be cleaned are first sorted into five classes:—1. White silk goods and coloured articles in which white predominates. 2. Light-coloured woollen or half woollen goods. 3. Velvets and other coloured silk goods. 4. Woollen or half-woollen goods of medium colour. 5. Dark-coloured articles. Each piece in the order of classification is spread out on a table, and the coarser stains are well rubbed with a tampon soaked in benzine [petroleum spirit]. They are then washed in the same order successively in each of the five cylindrical vessels containing benzine. In this way the white articles always encounter clean benzine, and the other classes are washed in the order of their colour as the benzine becomes more impure and darker. The goods are then again examined and local treatment applied with brushes and benzine if any spots remain. They are allowed to drain and dried in a wringer or centrifugal, and finally in a drying box heated to 70°—75° C. In larger establishments the five cylindrical vessels are replaced by power washing-machines, and a large drying room is provided. If any stains remain after the benzine treatment other means must be adopted, such as local brushing with soap and water. The most tenacious stains are those of oil, paint, and resins, and these are treated with turpentine and blotting paper. The nap or pile of woollen goods can be restored equal to new by blowing steam through them from underneath.—J. F. B.

Fibres, Microscopical Identification of Some Useful. B. S. Summers.

See under New York Section, *page* 989.

PATENTS.

Fabrics or Tissues from Liquid or Plastic Materials, Producing. A. Millar, Helensburgh. Eng. Pat. 17,549, Aug. 15, 1898.

An endless band of oilcloth or waxcloth, about 12 yards long and 1 yard wide, is placed on rollers, and as this band travels, a thread of some plastic material, such as gutta-percha, india-rubber, nitrocellulose, gelatin, albumin, or any substance which can be subsequently made non-plastic and tenacious, is squeezed out by pressure from a fine jet on to the band. The arrangements of the machine are so adjusted that, when the band has made one revolution, the position of the jet shall have moved about $\frac{1}{20}$th in., so that the second thread is just a little in advance of the first, and there is no overlapping. It is evident that if several jets are applied at each end of the band, and various movements given to them, a fabric can be produced.

To ensure adhesion of the threads at their points of contact, the tissues may be passed under a pressure roller or a jet of air may be blown upon the tissue, charged or not, with vapour, or liquid, as the case may require. The substances named are dissolved in suitable solvents, and if heat be necessary the cylinders containing them are jacketed with hot water.—C. M.

Composition-covered Rollers Employed in Textile Spinning and for like Uses. A. Bennie, St. Petersburg. Eng. Pat. 22,321, Oct. 24, 1898.

This invention is an improvement on that of Eng. Pat. 3686, Feb. 14, 1898. In that specification, leather dust was used and side flanges were fixed to the rollers. The following composition is found to be more advantageous for spinning and drawing rollers:—Sawdust, half beech and half pine), finely ground, 39 parts; gelatin, 24 parts; glycerin, 17 parts; water, 20 parts.

This mixture is moulded when hot on to the periphery of metal discs of exactly the same diameter as the actual wooden boss. When moulded, they are slipped off and put in a cool place to dry, and afterwards glued on to the wooden boss. For twisting rollers, the following composition is used:—Old composition turnings, 22 parts; gelatin, 3 parts; water, 75 parts.

This is also moulded on to a wooden boss. It is claimed that these rollers, having no joint, do not slip like those covered with leather.—C. M.

Planking Felt Hat Bodies, Apparatus for Pumping the Liquor in Machines for; applicable also to the Pumping of other Corrosive Liquids. O. Oldham, of Oldham and Son, Denton, Lancashire. Eng. Pat. 23,664, Nov. 10, 1898.

An air pump or other air-compressing apparatus is connected with the liquor pipe, between the liquor tank and the perforated spray pipe, in such a way that the circulation of the liquor is maintained by the compressed air, without the acid liquor coming into contact with and corroding the working parts of the pump, &c.—R. A.

Fireproofing Compositions. G. X. Dime, New York, U.S.A. Eng. Pat. 13,238, June 26, 1899.

See under IX., *page* 1022.

Textile Materials, Treatment of, with Liquids or Gases, and Apparatus for that Purpose. W. Mather, Manchester. Eng. Pat. 16,730, Aug. 17, 1899.

In this invention, cloth in full width is wound on to spindles, preferably going through a soaking bath in the process.

When a roll of suitable size has been made, it is placed in a chamber, which has perforated plates at the ends, through which the liquid with which the cloth is to be treated, passes.

Having tightly closed down the chamber, liquid is pumped into it through the perforated end, and is forced through the layers of cloth in a direction parallel to the axis of the roll.

A chamber for a double roll may be made by having a perforated partition in the middle and attaching the two rolls to two mandrels projecting from the central plate.

The closed kier and truck arrangement may be used in this process by rolling the cloth end on in the trucks, and then wheeling them into the chamber. The truck has a perforated bottom, and the liquid is forced up through the bottom of the chamber and through the rolls of the cloth.

—C. M.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Bleaching Textiles with Sodium Peroxide. H. de la Coux. Rev. Chim. Industr. **10**, [117], 252—254.

The evolution of hydrogen peroxide from the sodium salt being favoured by alkalinity and heat, it becomes necessary, in order to ensure gradual disengagement of the bleaching agent, to regulate these two factors, and since the former is always present to excess, from the NaOH formed, which, moreover, may have an injurious effect on the fabric under treatment—it must be neutralised and a slight degree of alkalinity restored by means of ammonia.

Three types of bath are employed in this bleaching, their composition being as follows:—

1. *Sulphuric Acid and Ammonium Phosphate Bath.*—Containing: Water, 98 litres; sulphuric acid of 66° B., 800 grms.; ammonium phosphate, 300 grms.; sodium peroxide, 350 grms.

2. *Sulphuric Acid Bath.*—Cold water, 100 litres; sulphuric acid of 66° B., 1·35 kilos.; sodium peroxide, 1 kilo. If exhibiting an acid reaction, ammonia is added until alkaline.

3. *Magnesium Sulphate Bath.*—Magnesium salts facilitate bleaching by sodium peroxide and are superior in this respect to zinc oxide. The most efficient bath is prepared from:—water, 95 litres; magnesium sulphate, 3 kilos., sodium peroxide, 1 kilo. The excessive alkalinity must be corrected by sulphuric acid.

Whichever type of bath is used, the reaction must always be tested with litmus paper and corrected to slight alkalinity, accordingly, magnesia being preferable to ammonia, as an alkaline addition to baths 2 and 3. The vats used must be of some material unaffected by sodium peroxide, iron being discarded in favour of wood, earthenware, or enamelled materials.

The fabrics treated must be previously freed from oily matters, and should be completely covered by the bath liquor, uniformity of action and proper distribution of the nascent gas being facilitated by occasionally working the goods about in the bath. The following table indicates the most suitable strength of bath liquor, temperature and duration of treatment for various fabrics.

Material.	Percentage of Na_2O_2 in Bath.	Bath Temperature.	Duration of Treatments in Hours.	Weight of Na_2O_2 per 100 parts of Material treated.
		° C.		
Cotton........	1	30—40	1—3	1
Linen.........	1	40—50	10—11	1
Wool.........	2—3	50	4—5	2—3
Silk..........	4—6	80	4—8	3—5
Straw........	1	30—40	2—4	1—2
Wax..........	2—3	(1) 30—40 afterwards (2) to melting point.	3—4 1—2	5

The bath may be recuperated by an addition of one-half the original weight of peroxide, the other matters in proportion; but it is better to use the spent bath as a preliminary bleach, completing the operation in a freshly prepared liquor. After bleaching, the materials are entered in dilute (0·04 per cent.) sulphuric acid for ¼ hour, and washed until quite free from acid. Other acids may be used in place of sulphuric acid, oxalic, and tartaric acids being employed for straw, and acetic acid for wool.

The peroxide baths will keep unchanged, if slightly acidified by sulphuric acid, but the dry salt must be stored in air-tight boxes.—C. S.

Wool, Action of Nitrous Acid on. V. Flick. Bull. Soc., Ind. Mulhouse, 1899, 221—226.

Richard (this Journal, 1888, 841) observed that when wool is treated with a solution of nitrous acid, and then with alkaline solutions of phenols, it is coloured orange, red, &c., according to the phenol employed. The author has made an extended study of this reaction.

Acted upon in the dark with a solution of $\frac{1}{15}$th of its weight of sodium nitrite, to which sufficient hydrochloric acid is added to liberate the nitrous acid, wool becomes after some time coloured yellow. Treated with boiling water, this colour changes to brown. A dilute solution of caustic soda transforms the colour into a dull brown, which is restored to yellow on treatment with an acid. A hot solution of stannous chloride destroys the colour, but it is reproduced on immersing the wool again in a solution of nitrous acid. Wool, which has been subjected to the action of nitrous acid possesses greater affinity for basic dyestuffs than does wool in its normal condition. This may be shown by printing a thickened solution of sodium nitrite upon wool, which has been prepared in a 25 per cent. solution of tartaric acid, and then dyeing it with Magenta. Two shades of colour are obtained.

Wool, which has been acted upon by nitrous acid, rapidly loses its colour on exposure to light, and then takes an orange colour on immersion in a solution of caustic soda. It still retains its increased affinity for basic dyestuffs. If it be treated before or during exposure with acid gases, instead of being bleached, it is darkened to an orange colour by the action of light.

A concentrated neutral solution of sodium nitrite produces a salmon colour on wool which is immersed in it, and then heated at 100°--110° C.

On treating wool which has been modified by the action of nitrous acid, with aqueous solutions of various phenols, it undergoes in the course of a few minutes a striking change in colour. With α- and β-naphthol in dilute boiling solutions of the quantity of sodium carbonate theoretically necessary to combine with them, the change is almost instantaneously produced. The following colorations are obtained in this way:—With resorcinol and orcinol, orange; pyrogallol, brownish yellow; phloroglucinol, purplish red; α- and β-naphthol, red. (The brown coloration formed by the action of a caustic alkaline solution of phenol, noticed by Richard, is believed to be due to the action of the alkali in excess.) Concentrated solutions of acids change the coloration given by resorcinol into bright red, those from orcinol and β-naphthol into orange, and that from α-naphthol into a very dark shade, almost a black. The original colours are re-obtained on washing in water. Ferrous sulphate, stannous chloride, potassium bichromate, aluminium sulphate and copper sulphate, act upon the colours, giving respectively dull purples and olive-browns, bright reds and oranges, purplish-reds, oranges, and dull reds. The treatment with stannous chloride must not be of long duration, otherwise the colours are destroyed. The colours which are mordanted in this manner are fairly fast to light, very fast to boiling water, acids and milling.

The author accepts Prud'homme's view (this Journal, 1898, 663), as to the nature of the yellow compound formed by the action of nitrous acid. The colouring matters which are produced on developing it with phenols, and subsequently treating it with various metallic salts, exhibit a close analogy to quinone-oxime compounds. It would, therefore, appear to be probable that at the moment of their formation, a molecular transposition takes place, the nitroso group, present in the molecule of the yellow compound, passing over to an ortho position, relatively to one of the hydroxyl groups. The affinity of the yellow compound for basic dyestuffs may also be explained on this assumption.—E. B.

Report on the Preceding Paper (*Wool, The Chemical Nature of, &c.* V. Flick.) E. Grandmougin and H. Bourry. Bull. Soc. Ind. Mulhouse, 1899, 227—230.

In spite of the work of Richard (*loc. cit.*), Bentz and Farrell (this Journal, 1897, 405) and Obermayer (Monit. Scient. 1893, 312) on the formation of colours by the action of phenols and amido compounds on wool which has been treated with nitrous acid, the problem as to their nature still remains unsolved. Flick has not succeeded in definitely deciding the question, but he has made certain observations which merit attention. The authors are able in the main to confirm them.

The action of nitrous acid upon wool is very slow. About 24 hours' time is required for the fibre to become coloured a full yellow. The whole of the acid employed is not indeed then absorbed. The *nitrosated wool,* as the authors provisionally term the product, can be dried unchanged at a low temperature and in the absence of light. When dry it must be kept in the dark, as it is very sensitive to light. By the action of boiling water or of steam it is rendered brown in colour, and is deprived of its property of reacting with alkaline solutions of various phenols. Phenol itself in alkaline solution gives with the nitrosated wool a coloration which differs so little from that which is obtained by the action of the alkali alone that it is doubtful whether it reacts.

A concentrated neutral solution of sodium nitrite appears to be practically without action on wool which has been scoured and not bleached. It probably acts upon bleached wool owing to the presence in this of traces of acid.

The employment of a hot dilute solution of sodium carbonate in place of the rather concentrated solution of caustic alkali used by Richard in the development of the phenol colours is an improvement, as the fibre is less injured. The colours obtained are changed in shade when they are treated with dilute solutions of acids. They yield other colour changes with concentrated solutions; thus, the compound obtained from α-naphthol is changed by concentrated acids to green, and becomes successively purple and red on washing, like a disazo-α-naphthol compound.

Flick has not succeeded in obtaining combinations with amido bases. With α-naphthylamine the authors found that a brown-orange colour is produced, slowly in the cold and more rapidly on heating, which is changed by concentrated acids to a blue, the latter remaining after washing, but being reconverted into brown by alkalis.

Prud'homme has based his opinion as to the nature of the compound produced by the action of nitrous acid on wool upon a test which gave a negative result. If the compound be, as Prud'homme considers, a nitroso compound, it should give Liebermann's nitroso reaction, but it does not do so. The question, therefore, still remains open.—E. B.

Mercerised Yarn, Fading of Dyed. Textile Colorist, 1899, **21**, [249], 258.

It has been noticed that mercerised yarn which has been dyed with some of the direct dyestuffs, fades much faster than plain yarn when dyed with the same dyestuff, and also that the fading takes place whether the yarn be exposed to the light or otherwise, which fact appears to point to the conclusion that there is some chemical action at work which has an influence on the dyestuff. It is possible that the chemically combined sodium present in mercerised cotton may have an influence in the destruction of the dyestuff, although weak alkalis have, as a rule, a beneficial effect on many of the direct dyestuffs by brightening them.

It is stated that the direct dyestuffs appear to be those best suited to mercerised cotton, and that it would be interesting as tending to a solution of the fading problem, to determine what action the chlorine of bleaching powder has on mercerised cotton, and whether such bleached stock is more active in eventually causing a fading of the dyed goods.—A. S.

Dyeing Cotton Yarns and Tissues, Mercerised under Tension. F. Kampe. Färber-Zeit. 1899, **10**, [16], 256—259.

To secure even and regular dyeing in the case of cotton yarns and tissues which are treated under tension with caustic soda, it is recommended that they should be boiled in water or in a solution of sodium carbonate before being treated with the concentrated caustic soda solution.

Yarns should be dyed (with direct cotton dyestuffs) pale shades in a bath containing 40—50 parts of soft water per part of the material dyed. Soap or sodium carbonate in sufficient quantity to render the bath distinctly alkaline should be added to it, together with common salt or sodium sulphate. The yarns, previously boiled, and in the form of hanks, are worked in this for 10—15 minutes at a temperature not exceeding 40° C. They are removed, the dyestuff added, and are then again placed in the bath and worked in it until they are dyed. If soap be used in the dye-bath, they need not be rinsed afterwards. Tissues are best dyed in a dye-jigger, or, in the case of pale shades, in a padding machine. They cannot be satisfactorily dyed in the rope state. When the padding machine is used, the tissue, if in the wet state, is given two passages through a solution of soap or soda at 40° C.; if dry, it is passed twice through one of these solutions at 80° C., and then through cold water. The dye-bath is prepared with about a fourth of the quantity of dyestuff required for the shade it is intended to dye, along with sodium carbonate or soap. The tissue is passed through this, cold. A further quantity of the dyestuff solution, with more carbonate of soda or soap, is added to the bath and the tissue is again passed through it. This is repeated until the tissue is dyed. When dyeing in the jigger, the temperature of the bath should be so regulated that more of the dyestuff is absorbed by the tissue than is left in the bath. To this end samples of the bath should be frequently taken and compared with samples of the dyed tissue. In dyeing dark shades the temperature should be raised to 80°—100° C.—E. B.

Dyeing Loose Hare and Rabbit Fur, New Black Dye for. Deutsche Hutmacher Zeit. **31**, [1].

The tendency of black-dyed hare and rabbit fur to "bleed" may, it is stated, be prevented by dyeing with "Anthracene Chrome Black," the bath containing 300—600 grms. of ammonium oxalate—according to the hardness of water—per 1,000 litres, and acetic acid, 5 per cent.; Anthracene Chrome Black F, 20 per cent.; Anthracene Yellow B N, 2 per cent.; Brilliant Fulling Green B, 2 per cent.

The fur, packed in canvas bags to prevent excessive felting, is entered into the warm bath and kept nearly boiling for about 45 minutes. 7—8 per cent. of dilute sulphuric acid is then added, and after another ¾ hour's boiling to exhaust the bath, the colour is fixed by boiling for 35—40 minutes with an addition of 3 per cent. of potassium chromate. This last operation can be performed in a separate bath containing 2—3 per cent. of hydrochloric acid, or 2 per cent. of sulphuric acid in addition to the chromate. The single bath is, however, preferable, since transferring the fur increases its tendency to felt.

The resulting black is said to be quite fast to fulling and light; and the fur binds well in the fulling process and yields hat bodies that handle full and firm.—C. S.

Woollen Tissues, Defective Penetration in the Dyeing of. Leipziger Färber- und Zeugdr. Zeit. 1899, **48**, [8], 324.

The following are the chief causes of defective dyeing in the case of woollen tissues:—

(I.) Imperfect scouring.

(II.) Incomplete saturation of the tissue with water prior to its entering into the mordanting bath.

(III.) Defective mordanting, due to the process being commenced at a high temperature.

(IV.) Dark coloured lists are produced by the continued action on the wool of the mordanting liquor retained by it after its withdrawal from the bath. Their formation may be avoided by passing the tissue through a cold water rinsing bath as it leaves the mordanting bath.

(V.) Exposure to light in the interval between mordanting and dyeing.

In dyeing with colouring matters of the Alizarin class, ⅓—⅔ of a kilo. of ammonium acetate should be added to the bath for each piece of 25 kilos. in weight dyed. The temperature of the bath should not, at the beginning, exceed 25—30° C., and should be gradually raised to the boil. Completion of the dyeing is accomplished by an addition of acetic acid. If the shade obtained be too pale, requiring to be further dyed, the bath must be allowed to cool before any addition of dyestuff is made to it, and it must be again heated gradually. It is usually advisable, however, in such a case, to employ in the second dyeing operation a non-mordant dyestuff, on account of the difficulty of obtaining the desired shade of colour with dyestuffs of the Alizarin group after the operation of dyeing with them has once been interrupted.

The proportion of alkali bichromate employed in mordanting should be regulated by the intensity of the colour subsequently to be dyed, considerably less being necessary for pale than for deep shades.—E. B.

Felted-Fur Hats, Manufacture and Dyeing of. Deutsche Hutmacher Zeit. **30**, [41 and 42].

After stiffening, the hats are dried, steamed, re-dried, and the nap freed from shellac by means of a stiff brush, after which they are rinsed in a boiling hot bath of sodium carbonate, 700 to 800 grms. of which (soda crystals) in 100 litres of water will suffice for about 100 light hats or 50 heavy or highly stiffened ones. The hats are left in the bath until the formation of bubbles on the material ceases, and are then transferred to lukewarm water, to wash away the soda, the operation concluding with one or two washings, and draining in the hydro-extractor.

The principal point is to ensure the thorough fixation of the dye—an end attained by working the hats about in the bath for some little time after the colouring matter has been absorbed, and by providing a sufficiency of acid, a slight excess being harmless.

For dyeing the felts in a single bath the following recipes are recommended:—

Mode Colour.—Cyanol extra, 0·05; Orange G G, 0·09; Lanafuchsin S G, 0·18 per cent.

Fawn.—Cyanol extra, 1; Orange G G, 5; Lanafuchsin S G, 0·09 per cent.

Brown.—Cyanol extra, 0·06; Orange G G, 3; Lanafuchsin S G, 0·06 per cent.

Slate Gray.—Cyanol extra, 0·05; Orange G G, 0·02; Lanafuchsin S G, 0·20 per cent.

Green.—Fast Acid Green B N, 5·05; Fast Yellow S, 3·05 per cent.

Nankin.—Orange G G, 0·02; Cyanol extra, 0·06; Lanafuchsin S G, 0·08 per cent.

Pale Green.—Fast Acid Green, 2; Tropæolin O O, 2·25 per cent.

The bath contains 10 per cent. of sodium sulphate and 5 per cent. of acetic acid. The goods are entered at 100° F. and slowly raised to gentle boiling, where they are kept for ¾ hour before and after the addition of 1 per cent. of sulphuric acid. If boiled too hard the felt will shrink to an undesirable extent.

For black, the bath is prepared by adding ½ grm. of ammonium oxalate per 1 litre of water, followed by 20 per cent. of sodium sulphate, 5 per cent. of acetic acid, 14 per cent. of Anthracene Chrome Black F; Anthracene Yellow B N, 15 per cent.; Fast Acid Green B N, 15 per cent. After boiling the goods for ¾ hour, about 15 per cent. of cream of tartar is added (or 6 per cent. of sulphuric acid) and boiling continued until the bath is nearly exhausted, whereupon they are transferred to fresh water and after-chromed by gentle boiling for ½ hour with 2⅓ per cent. of potassium chromate and 2½ per cent. of concentrated hydrochloric acid.—C. S.

Ladies' Hat Bodies, Influence of Steam on the Colour of. Deutsche Strohhut Zeit. Oesterr.-Ungar. Hutmacher Zeit. **16**, [16], 4.

Where, for cheap goods, fast colours are not used, the shade is liable to undergo alteration in the steaming process, especially when the apparatus is of such a kind that moisture is deposited therein by condensation. This change is mainly due to the alkaline matters used in stiffening, and also to the use of alkaline anti-incrustation preparations in the steam boiler. The remedy is to apply a weak solution of acid by means of a brush. In the case of grey hat bodies turning green when steamed, a warm solution of ¼ litre of concentrated acetic acid in 5 litres of water is used. A small quantity only is applied, in order to prevent the bodies getting out of shape, and if the first application does not restore the colour the solution should be made stronger in preference to using a larger quantity. Sometimes, when the bodies have originally failed to match the sample, in dyeing, and have consequently been touched up with acid, a different shade (bluish) will result from the treatment described, and in such event a few drops of ammonia added to the solution will rectify the colour. When dealing with mordanted or mode colours, which have turned dark yellow or reddish on steaming, ammonia and borax are used instead of acetic acid. If the shade be more reddish a larger proportion of ammonia is used; but if more yellowish the borax ratio is increased. Greens, blues, and browns seldom suffer in steaming; but if they do, very dilute sulphuric acid will afford a remedy. When it is certain that the colours have been dyed in an acid bath, alkaline stiffenings should be avoided.—C. S.

Anthracene Chrome Black. O. Walther. Färber-Zeit. 1899, **10**, [17], 271—273.

Anthracene Chrome Black F gives on loose wool, a colour which is characterised by its evenness, cleanness, and fastness to light, milling and acids, while the wool, although thoroughly penetrated, is left by it soft and in a condition suitable for spinning and milling.

The process of applying the dyestuff is as follows:— When the water employed in dyeing is calcareous, an addition of 300—600 grms. of ammonium oxalate per 1,000 litres is made to the dye-bath, then 5 per cent. (of the weight of the wool) of acetic acid is added, along with the necessary amount (6½ per cent.) of dyestuff. The bath is heated and the wool, in either the wet or dry state, is introduced. The bath is boiled for ½—¾ hour, then 5—7 per cent. of sodium bisulphate or 2—2½ per cent. of sulphuric acid is added to it in two portions, and the boiling is continued until the bath has only a pale, reddish colour. 1¼—1½ per cent of potassium bichromate is next added, after which the bath is gently boiled for half an hour. Dyed in this manner, the wool has a full black colour, similar to a well dyed Logwood black. If desired, the colour may be shaded with Anthracene Acid Brown R or G, for a jet black, or with Anthracene Yellow B N, for a greenish-black.

The dye-baths may be preserved and used for dyeing several lots of wool in succession in the same manner as those employed in dyeing Alizarin Black and Diamond Black. The second and subsequent lots are boiled 20 minutes in the old bath, then the bath is cooled by the addition of water, the amount of dyestuff removed by the previous lot of wool is added, and after raising the bath to the boil and boiling for a short time, the sodium bisulphate or sulphuric acid is added, and, lastly, the potassium bichromate. If dyeing in two baths is preferred, which is the better method when large quantities of wool are to be dyed, 1½—2 per cent. of hydrochloric acid should be added to the second, that is, the chrome bath, for the first lot of wool dyed, and three-quarters of this amount of acid and of the amount of potassium bichromate originally added, to the same bath, for subsequent lots of wool.—E. B.

Printed Calicos, Method of Producing Crépon and Moiré Effects upon. P. Dosne. Bull. Soc. Ind. Mulhouse, 1899, 213—215.

A STRIPE pattern is first printed in a colour capable of withstanding the action of a concentrated solution of caustic soda, and after the tissue has been washed or soaped and dried, a thick solution of gum is printed upon it from a deeply engraved roller in a pattern similar to the first, but at a slight angle across it. The tissue is next passed, without any tension upon it, through a solution of caustic soda at 38° B., and is washed and dried. (See also this Journal, 1899, 38.)—E. B.

Ground Colours with Direct Dyestuffs and Tannin before being Discharged in Colours, The Preparation of. Ed. Justin-Mueller. Rev. Gén. des Mat. Col. 1899, **3**, [34], 350.

IN the use of tin discharge colours with tannin, more or less tin tannate is always formed, and this, after steaming, is superficially deposited on the fabric, and in washing becomes detached, carrying with it some of the colouring matter. This superficial removal of the dyestuff diminishes the intensity of the coloured discharge and if not thoroughly washed away, stains the ground colour. The same objection applies to white discharges.

To avoid this, the process used for coloured discharges on black grounds dyed with Oxydiamine Black A is adopted. After dyeing, the fabric is padded in a 10 to 20 per cent. solution of tannin, then, according to the case, the discharge colours are printed, or previously fixed with an antimony salt, or a mixture of antimony salt and sodium chloride is added to the printing paste. When coloured discharges are not used, the treatment with tannin is still advantageous, for it increases the intensity of the black.

In order to avoid the passage through the tannin bath an attempt has been made to add the tannin to the dye-bath. In certain cases this works well if the tannin be neutralised or made slightly alkaline with caustic soda. Tannin, previously made slightly alkaline, to the extent of 2 to 4 per cent. of the fabric (or an equivalent quantity of sumach extract), is added to the dye-bath—using the jigger or padding machine. After dyeing, the cloth is squeezed without rinsing, or, in other cases, is passed through an antimony solution, then rinsed and dried. In this way the tannin is taken up well by the fabric during dyeing, and the bath remains normal and may be used again.—J. McC.

***Stearin, Paraffin, and Wax, Fixation of, in Aniline Dyestuffs** Soluble in Alcohol.* Hermignies. Rev. Prod. Chim. **2**, [15], 227.

A FAST and stable shade of colour is obtained by dissolving 8 grms. of Rhodamine in 200 grms. of 95 per cent. alcohol, the solution being then filtered, mixed with 1 kilo. of ammonium sulphoricinoleate—in a stoneware jar placed in a warm and ventilated chamber, and shaken up at intervals—and finally incorporated by mixing with 100 kilos. of a melted mixture of 67 per cent. of stearin and 33 per cent. of American paraffin.—C. S.

Farina (Potato Starch) Valuation of, for Calico Printers. C. Saare. Leipziger Färber- und Zeugdr.-Zeit. 1899, **48**, [8], 323—335.

See under XVI., *page* 1038.

***Gum from certain Species of Mesembryanthemum ("Gomme** Vierge Végétale"), Use of, in Calico Printing.* Achon-Bitz. Rev. Gén. Mat. Col. 1899, **3**, [33], 317.

See under XVI., *page* 1038.

PATENTS.

Textile and other Fabrics, Impts. in Printing. S. H. Sharp and S. H. Sharp and Sons (Leeds), Ltd., Leeds. Eng. Pat. 6063, March 20, 1899.

THE object of this invention, which is to print patterns in two or more colours in accurate alignment, is accomplished by means of endless stencil plates, provided with indentations or recesses which serve to print one or more colours, whilst another colour is printed through the perforations of the plates.

The plates from which the stencils are made are produced by the electro-deposition of suitable metals on cylindrical cores, or are formed by bending sheets of metal, and brazing or soldering together the ends.

The tissue to be printed, is passed over tension rollers and a spreading roller, to an endless blanket, which conveys it to the stencil plate, a cylinder, and pressing roller, at the point of contact of which it is printed. Thence it is drawn, as usual, away from the machine.

After printing, the stencil plate goes round a roller, where it is damped with turpentine, then past a doctor, a revolving brush and revolving wiper, forward again to the first "ink duct." The effects may be varied by dividing the "ink ducts" into several compartments, or by arranging several of them side by side, and supplying them with different colours.

A claim is specially made for the invention, as part of a stencil tissue-printing machine, of a right- and left-hand screw-threaded spreading roller furnished with means for moving it from side to side.—E. B.

Indigo Vat** [Calcium Hydrosulphite], **A New or Improved. J. Grossmann, Manchester. Eng. Pat. 20,865, Oct. 4, 1898.

INDIGO and other dyestuffs which form leuco-derivatives, are reduced by means of the hydrosulphites (hyposulphites) of calcium, zinc, "and similar compounds of the alkaline earths, and of certain metals which have the property of reducing indigo." These are sparingly soluble and comparatively stable compounds, and are "particularly useful for indigo dyeing." In order to prepare a stock solution of reduced Indigo for use in dyeing, finely-ground Indigo is, for example, mixed with the necessary quantity of milk of lime and a suitable quantity of water, and heated to 40°—50° C. The mixture is stirred and calcium hydrosulphite, in the form of a paste, is added, a small quantity at a time, until the reduction is completed. The free lime in this example, may be replaced by suitable quantities of the hydrates, carbonates, bicarbonates, sulphates, or sulphites of soda, potash and ammonia, some of these compounds, by double decomposition, giving soda, potash, or ammonia vats. (See this Journal, 1899, 915.)—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Fluorine, Electrolytic Method of Preparation in a Copper Apparatus. H. Moissan. Rev. Prod. Chim. **2**, [17], 258.

To reduce the expense caused by the corrosion of the platinum vessel in the ordinary process, the author, having found that copper is less subject to attack than any other metal—provided the acid used is free from water—now employs a copper vessel, but retains the platinum electrodes, since those of copper rapidly become covered with a layer of copper fluoride, which resists the passage of the current. The copper vessel has a capacity of about 300 c.c., the working charge being 200 c.c. of hydrofluoric acid and 60 grms. of potassium fluoride. To increase the area of the electrodes, they are now made in the form of open hollow cylinders instead of rods.

An examination of the volume of hydrogen liberated, shows that the method yields good results. With a 50-volt, 15-ampère current, about 5 litres per hour are obtained, the quantity being increased to 8 litres by raising the amperage to 20. In the latter case, however, the liquid heats rapidly, and despite the employment of a very low temperature (− 50° C.), the fluorine carries off a large proportion of hydrogen fluoride; moreover, when the temperature is so greatly lowered, the compound of hydrofluoric acid and alkali fluoride is liable to congeal.

It is probable that the walls of the vessel are protected by the deposition of a thin insulating layer of copper fluoride. —C. S.

Lead Sulphate, Solubility of, in Ammonium Acetate. J. C. Long. Amer. Chem. J. **22**, [3], 217—218.

An aqueous solution of ammonium acetate containing 29 to 34·3 per cent. of the salt has the greatest solvent power for lead sulphate.

To dissolve lead sulphate, boil with a 33 per cent. solution of ammonium acetate (sp. gr. = 1·07) using 10 c.c. for each gram of the sulphate. In recovering the lead sulphate from the solution, the addition of 0·5 grm. of sulphuric acid greatly facilitates the evaporation and subsequent expulsion of the ammonium acetate.—J. McC.

Hydrochloric Acid, Electrolysis of. Haber and Grindberg. Zeits. anorg. Chem. **16**, 198—228; 329—361 and 418—449.

See under XI. A., *page* 1028.

Tartaric Acid and its Compounds, Colour Reaction for Recognising, and Distinction from Citric Acid. J. Wolff. Ann. Chem. anal. appl. **4**, 263; Chem. Centr. 1899, **2**, [11], 569.

See under XXIII., *page* 1055.

PATENTS.

Iodine and Gelatinous Matter, The Preservation and Treatment of Kelp for the Extraction of, and the Employment of the latter for Waterproofing Fabrics, Paper, Leather, Wood, and the like. S. Pitt, Sutton. From G. Laureau, Son, and Co., Quiberon, Morbihan, France, Eng. Pat. 20,356, Sept. 26, 1898.

Kelp is preserved by means of heavy gas oils. Thus the daily manufacture of fucose is not dependent upon the arrival of kelp, the latter being designed for incineration and treatment for extraction of a gelatinous substance from it suitable for waterproofing fabrics, wood, &c. The kelp to this end is macerated in acidulated water, steamed at a pressure of from 2—4 atmospheres, filtered, the matter to be extracted from the cellulose being thus separated. The saline liquors obtained are treated for the extraction of iodine.—S. K.

Ozone, Apparatus for Generating. Baron H. Tindal, Amsterdam. Eng. Pat. 24,543, Nov. 21, 1898.

See under XI. A., *page* 1029.

Baryta, Manufacture of. H. H. Lake, London. From La Société Bonnet Ramel Savigny, Giraud et Marnas, Lyons, France. Eng. Pat. 25,027, Nov. 26, 1898.

Barium carbonate, finely powdered, is intimately mixed with about 8 per cent. of its weight of carbon, and the mixture is placed in a crucible lined with cardboard, or other vegetable fibre, which is also used to cover the mixture, and the lid is luted down with earth. The crucible is heated for about 10 hours to 1100°—1200° C. during which heating the escaping gases prevent external gases or water vapour from gaining access, this exclusion being a condition necessary to success. It is stated that in this process about 99 per cent. of the barium carbonate is transformed into anhydrous baryta, from which, if required, the hydrate may be obtained by solution in water and crystallisation. Plumbago crucibles are preferably used, or they may be of coke dust mixed with refractory earth. —E. S.

Hypochlorite of Soda, Manufacture of. M. Muspratt, E. S. Smith, and The United Alkali Company, Limited, Liverpool. Eng. Pat. 25,748, Dec. 6, 1898.

To obtain a solution of sodium hypochlorite of high strength of available chlorine, chlorine is passed into a solution of caustic soda until sodium chloride begins to be deposited; the salt is then removed and the clear liquor is subjected to further chlorination. At no point should the solution be without an excess of free caustic alkali. When hypochlorites are manufactured from chloride of lime and a soluble sodium salt, as the carbonate or sulphate, the sodium chloride deposited is removed with the insoluble lime salt. It is stated that "the chief advantage gained by this invention is the obtainment of a clear solution of hypochlorite of soda which contains less than its equivalent of sodium chloride, thus enabling a solution to be obtained containing a higher percentage of chlorine than has hitherto been possible."—E. S.

Hypochlorite of Soda, Manufacture of. M. Muspratt, E. S. Smith, and The United Alkali Company, Limited, Liverpool. Eng. Pat. 25,925, Dec. 8, 1898.

To obtain sodium hypochlorite in a crystalline form, a solution of suitable strength, such as may contain, for instance, 400 grms. of chlorine per litre, is subjected to a low temperature, "when a considerable deposit of crystals will take place."—E. S.

Hypochlorites of Alkalis, Manufacture of Solutions of. E. S. Smith and The United Alkali Company, Limited, Liverpool. Eng. Pat. 25,962, Dec. 8, 1898.

"Chloride of lime and a soluble salt of an alkali are allowed to react, and when the reaction is complete the liquid is decanted and further chloride of lime and soluble salt of an alkali are added to the clear liquor; a further reaction then takes place, and on settling, a solution of the hypochlorite of the alkali is produced of greater strength than is obtainable by the process of manufacture as hitherto conducted." The operation may be repeated according to the strength of liquor required.—E. S.

Hypochlorites of Alkalis, Manufacture of Solutions of. C. L. Higgins, M. Muspratt, E. S. Smith, and The United Alkali Company, Limited, Liverpool. Eng. Pat. 25,963, Dec. 8, 1898.

The stability of solutions of the alkali hypochlorites has been found to be injuriously affected by the presence of even very small quantities of metals capable of forming higher oxides having acid properties, such as iron. When iron is present as a ferrate, the addition of glycerin or alcohol removes it as hydroxide; or a soluble salt of barium may be added to precipitate barium ferrate. Or the ferrate may be reduced to a ferrite, and be then precipitated by a suitable reagent.—E. S.

Hydrocyanic Acid from Gases containing the same, Separation or Production of. J. Bueb, Dessau, Germany. Eng. Pat. 26,259, Dec. 12, 1898.

This invention relates to the extraction of hydrocyanic acid from gases (other than coal-gas) as obtained for example by the dry distillation of molasses or residues resulting from sugar refineries. It is also applicable to the separation of synthetically formed hydrocyanic acid from other gases combined therewith.

The gases to be treated are cooled, and if they contain ammonia, they are conducted through dilute sulphuric acid. They are then passed through a tower in contact with a current of alcohol of high percentage. The solution of hydrocyanic acid thus obtained, is subjected to fractional distillation, or the vapour of alcohol and hydrocyanic acid, which has been distilled off, is conducted through chambers containing alcoholic caustic alkali, wherein the cyanogen compound becomes precipitated in the form of an insoluble white powder.—D. B.

Brine, Process for the Purification of. **G. N. Vis, Schweitzerhalle, Switzerland. Eng. Pat. 26,777, Dec. 19, 1898.**

The object of the invention is the purification of brine from the sulphates present, so that the separation of salt from it may not be impeded by calcium sulphate. The purification is conducted in two stages, of which the first consists in treating the brine with calcium chloride, and removing the calcium sulphate deposited; and the second, in treating the cleared brine with barium carbonate in quantity sufficient to remove the remaining sulphuric acid as barium sulphate. In the first process, calcium chloride is added to the brine in "such a quantity that in addition to the conversion of the non-calcium sulphate into precipitated sulphate of calcium, also the greater part of the gypsum originally present in solution in the brine is caused to deposit." The mixture is moderately heated and stirred for some time, and after settling, the decanted liquid is agitated with a proportion of witherite corresponding to the remaining quantity of sulphate. The clear brine is then separated from the deposit, and concentrated to obtain salt. Brines containing a large proportion of sulphates are preferably treated in the initial stage with calcium hydroxide instead of with calcium chloride.—E. S.

Cupric Sulphate Solutions, Treating. O. Hofmann, Argentine, Kansas, U.S.A. Eng. Pat. 13,320, June 27, 1899.

See *under* X., *page* 1027.

VIII.—GLASS, POTTERY, ENAMELS.

Phosphate Glasses, Composition and Properties of. **O. Inwald. Chem. Ind. 22, [17 and 18], 376—382.**

Taking Schwarz normal glass, $Na_2O, CaO6SiO_2$, as a basis, a series of experiments was made, in which certain proportions of silica were replaced by phosphoric and boric acids, and certain proportions of lime by lead oxide and soda. Experiments were also made to test the influence of lime in the production of opalescent glass, by adding certain proportions to a glass of the formula $Na_2OCaO\ 5{\cdot}9SiO_2, 0{\cdot}1P_2O_5$. The question of resistance to atmospheric influences was also studied, and for this purpose, the solubility of the glass in water was taken as the index. In extracting the soluble matter, 10 grms. of the glass, first reduced to a uniform granular condition, were digested in 100 c.c. of water at first on the water-bath, and afterwards in the cold. The general results arrived at were as follows :—In normal glasses, phosphate of lime can only be introduced in the quantities required to produce satisfactory opalisation by employing very high temperatures. The capacity of the normal glasses for dissolving phosphate of lime is very limited, the replacement of silica by phosphoric acid corresponding to 1·61 per cent. of phosphate of lime being sufficient to produce opalisation on re-heating. The replacement of silica in normal glasses by phosphoric acid cannot be carried beyond the point corresponding to 15·5 per cent. of phosphate of lime, otherwise glass is not formed. In order to produce calcium phosphate glasses at low temperatures, it is necessary to make use of easily fusible glass. This can be done: 1st, by raising the relative proportion of the alkali to the lime (this, of course, reduces the power of the glass to withstand atmospheric influences); 2nd, by the addition of boric acid, and this is regarded as the best means, since the relative proportions of the other constituents are not interfered with; 3rd, by the use of lead in place of lime. Pure lead-alkali glass cannot be opalised by phosphoric acid; the presence of phosphate of lime is absolutely necessary. The ordinary lime-soda-phosphate glasses are more soluble in water than the lime-soda-silicates. The boro-phosphate-silicates withstand atmospheric influences better than the pure phosphate-silicates. Pure alkali - lead - phosphate silicates possess almost the same resistance to atmospheric influences as the normal lime-soda-silicates. Certain of the results confirm the usual statement that the phosphate of lime in phosphate milk glass is not chemically combined, but only held in suspension.—H. H. B. S.

Egyptian Pottery. **H. Le Chatelier. Comptes Rend. 1899, 129, [12], 477—480.**

The author had placed at his disposal by M. de Morgan a number of ancient funeral statuettes found during excavations carried out under his supervision in Egypt. The analyses of certain of these specimens, together with that of a natural sandstone of Egypt for comparison, are given below :—

—	1.	2.	3.	4.	Sandstone.
Silica	94·4	92·3	93·9	95·3	93·8
Alumina	2·4	1·1	1·0	1·6	1·0
Oxide of iron	0·2	0·3	0·13	0·4	0·25
Lime	1·3	0·6	1·7	1·65	0·07
Magnesia	..	..	..	..	2·7
Manganese	..	2·4	..	..	..
Oxide of copper	0·5	0·8	0·84	0·4	..
Soda	1·2	2·5	2·4	0·64	..
Water	..	..	..	..	1·5

Microscopic examination of the blue glaze showed that it consisted of quartzose sand and a copper glass.
—H. H. B. S.

Stoneware Body, Decoloration of, with Cobalt. **M. B. Sprechsaal, 23, [30], 920—921.**

In view of the difficulties experienced in concealing the yellow tinge in stoneware due to iron, by adding cobalt oxide to the glaze or body, or by mixing dissolved salts of this metal with the wet mass, the author recommends the incorporation with the mass, of solutions of cobalt sulphate, nitrate, phosphate, &c., and precipitating the same with ammonia.

To ensure reliable results, a stock solution of the cobalt solution should be prepared, and the amount of ammonia required for complete precipitation determined by titration or by calculation from the percentage strength of the commercial ammonia employed. The advantage of one or other of the above cobalt salts depends on the market price, coupled with the relative proportion of metal as determined by the molecular weight. The actual quantity taken will vary with the composition of the body and the desired degree of decoloration in view, and must be determined by experiment.—C. S.

Fluorine, Electrolytic Method of Preparation in a Copper Apparatus. **H. Moissan. Rev. Prod. Chim. 2, [17], 258.**

See under VII., *page* 1019.

PATENTS.

Enamelling Iron and other Metals. **J. Zerzog, Hof, Bavaria. Eng. Pat. 15,129, July 22, 1899.**

The enamel consists of red lead, borax, and flint, to which may be added magnesia, fluorspar, or broken glass, the exact composition depending upon whether it is required to be of a fusible or refractory character. Colouring oxides may also be added. The mixture is fused, cooled in water, and ground to a thin paste. The articles to be enamelled are dipped into this paste, and then dried and fired in a muffle.—H. H. B. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Artificial Stone, Use of Alkali Silicates in making. B. H. Füchten. Keramische Rundschau, 1899, 74; Glashütte, **29**, [7], 74.

The function of the alkali silicates (water-glass) as a component of artificial stone is to act as a cementing medium by forming with the alkaline earths, alumina, and lead oxide insoluble silicates which bind together the filling material—quartz sand, chippings of sandstone, granite, fluorspar, or other minerals, broken bricks, and raw or burned clay. The mass may be coloured *black* by up to 12 per cent. of carbon or graphite; *brown* by 8 per cent. (maximum) of manganese dioxide or dark ochre; *red*, by 6 per cent. of colcothar; *brick-red* by 4—7 per cent. of cinnabar; *orange* by 6—8 per cent. of minium; *yellow* by yellow ochre (6 per cent.) or chrome yellow (5—7 per cent.); *green* by 8 per cent. of chrome green; *blue* by 6—10 per cent. of Neuwied blue, Bremen blue, Cassel blue, or Napoleon blue; *white* by up to 20 per cent. of zinc white. Chrome green and zinc oxide will give artificial malachite; and imitation lapis lazuli is furnished by granular pyrites and "Cassel blue." Metallic oxides form the corresponding silicates, and zinc oxide mixed with levigated chalk furnishes a very warm, lustrous marble.

The ingredients are mixed in troughs fitted with stirrers, the proportions varying according to the strength of the alkali silicate and the subsequent treatment (pressing or casting) of the mass.

Imitation sandstone is compounded of, *e.g.*, 100 parts of limestone; sodium silicate of 42° B., 35 parts; fine quartz sand, 120—180; coarse sand, 180—250 parts.

Artificial basalt may be prepared by adding potassium sulphide and lead acetate, or equal parts of antimony ore and iron filings. For artificial marble 100 parts of marble dust or levigated chalk are mixed with powdered glass, 20; and sifted fine-grained limestone, 8 parts, with alkali silicate, the colouring matter being mixed in, more or less intimately, according to the effect desired.

A suitable mass for casting is furnished by alkali silicate and levigated chalk, 100 parts; slaked lime, 40; quicklime, 40; fine quartz sand, 200; coarse glass powder, 130; and diatomaceous earth or similar material, 80 parts (or 150 parts of fluorspar), the mass shrinking as it hardens.

Another artificial sandstone is supplied by hydraulic lime or cement, 50 parts; sand, 200—300 parts; sodium silicate (in dry powder), 5—6 per cent.; the mixture being moistened with about 10 per cent. of water and pressed into moulds.

The unsightly incrustation of alkali carbonate (from the liberated caustic alkali) often met with in this class of artificial stone, may be obviated by adding amorphous silica to combine with the free alkali, by lixiviation preferably with dilute hydrochloric acid, by steaming in closed cylinders, or impregnating with fluosilicate preparations.

Artificial stone may also be made with hydraulic mortar, the alkali silicate being added to harden the mass when set; a coating of fluosilicate is then advisable.—C. S.

India-Rubber and other Similar Waste. Gummi-Zeit. **14**, [1], 5.

See under XIII. C., *page* 1034.

PATENTS.

Waterproof Compositions for Use in the Manufacture of Roofing Felts, Brattice Cloths, Panels, Linings, Imitation Veneers, and the like. T. Thomson, Barrhead, County of Renfrew, N.B. Eng. Pat. 22,141, Oct. 21, 1898.

The principal ingredient in these compositions is finely-ground wood. In the manufacture of felts, brattice cloths, &c. the wood is used in conjunction with tar, pitch, or a resinous material. For very strong compositions, flax, jute, cotton croppings, caddis, or lint are added. Additions of lime or other drier and colouring matters may also be made. The materials are kneaded together and spread upon a fabric or run into sheets. In the manufacture of panels, linings, imitation veneers, &c., the wood is mixed with varnish and spread upon millboard or other material.

—H. H. B. S.

Artificial Stone, Manufacture of, Marble and the like. A. J. Boult, Middlesex. A communication from P. A. J. Gasse, Colombes (Seine), France. Eng. Pat. 22,882, Oct. 31, 1898.

The materials employed are unslaked lime and sand, marble, or other natural stone. The ingredients are mixed dry and filled into moulds. These are placed in an air-tight chamber and subjected to the action of a partial vacuum to exhaust the air from the interstices. Steam and hot water at 75—80 lb. pressure are then successively injected. Finally the blocks are dried, either by heat alone, or by heat in conjunction with exhaust.—H. H. B. S.

Artificial Stone, Manufacture of. G. A. Kiefer, Pappenheim, Bavaria. Eng. Pat. 22,242, Oct. 22, 1898.

Pulverised hydraulic lime is mixed with water, and sufficient sulphuric acid of 66° B. added to partially convert the lime into calcium sulphate. Some inert matter, such as sawdust, ashes, sand, or the like is then added, and, finally, a specially prepared gypsum, which has been carefully calcined, so as to render it completely anhydrous. The gypsum may or may not be first mixed with a solution of borax. The mass is run into moulds, and sets into hard blocks.—H. H. B. S.

Artificial Asphalt, Process for Producing. A. E. Alexander, London. From D. W. Peck, Syracuse, U.S.A. Eng. Pat. 24,629, Nov. 22, 1898.

Equal parts of coal tar and rosin are mixed with from 5 to 8 per cent. of petroleum residues. The temperature is then raised to 320° F. while the mixture is agitated, when an additional amount of petroleum residues—say, from 5 to 10 per cent. of the combined weight of the above ingredients —is added gradually, together with from 3 to 5 per cent. of sulphur, calculated on the total weight of the other ingredients, including the petroleum residue with which it is added. The mass is agitated, and its temperature increased to 350° F. or more.—D. B.

Artificial Asphalt, Producing. A. E. Alexander, London. From D. W. Peck, Syracuse, U.S.A. Eng. Pat. 24,630, Nov. 22, 1898.

The process consists in mixing equal parts of coal tar and rosin with from 10 to 20 per cent. of petroleum residues, raising the temperature of the mass with agitation, to 320° F., and then adding from 3 to 5 per cent. of sulphur, agitation being maintained, the temperature being also increased to 350° or 360° F. The percentage of sulphur is calculated on the total weight of the other ingredients mentioned.—D. B.

Cement, Manufacture of, and Apparatus therefor. C. F. A. E. H. von Forell, Giessen, Germany. Eng. Pat. 27,008, Dec. 21, 1898.

The essential feature of the invention consists in the raw materials in the manufacture of Portland cement being calcined in their natural condition, *i.e.*, without previous grinding. The apparatus employed consists of a furnace in two or more separate parts, constructed to rotate in an inclined position and at different speeds. Thus, if the furnace is divided into two parts, the drying and calcining processes are carried out in the upper part and the burning process in the lower. If the furnace is in three parts, the drying and calcining processes are conducted separately. If two rotating furnaces are used, these may be arranged one behind the other, with or without an intervening space, or they may be placed one above the other, or side by side. Arrangements may also be made for charging or discharging material between the two furnaces. The wet, raw materials during their passage through the furnace become mixed, dried, calcined, and burnt, and leave it as a finished product.—H. H. B. S.

Fireproofing Composition. G. X. Dime, New York, U.S.A. Eng. Pat. 13,238, June 26, 1899.

The composition consists, n 100 parts, of 92·88 ammonium chloride, 0·46 ammonium carbonate, and 6·66 microcosmic salt. The object of the ammonium carbonate is to neutralise free acid and throw down any iron or lime that may be present, free acid tending to impart a hygroscopic character and iron or lime to discolour the articles treated. In treating wood, ammonia alum may be added to the above ingredients as a preservative and to impart additional strength.—H. H. B. S.

Fireproofing, and Heat and Sound Insulating Compounds, and Method of Producing the same. E. Rueff, New York, U.S.A. Eng. Pat. 15,734, Aug. 1, 1899.

Calcined magnesite is mixed with a fibrous material such as asbestos, and water added, and the mass is then treated with carbon dioxide in quantity insufficient to produce normal carbonate. The material is finally dried and pressed into the required form.—H. H. B. S.

X.—METALLURGY.

Mine Surface Sampling. S. H. Pearce. Journ. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 155—161.

This paper contains a review of the various methods of sampling the ore material in its different forms and conditions, from the mill to slimes residues, during its passage through an extraction plant. The author points out the difficulty of correct sampling in every stage owing to the unequal distribution, size, specific gravity, and value of the ore constituents, even after concentration, and, whilst not pretending to remedy all the defects, he expresses his opinion on most of the best known methods and makes suggestions in respect to those which appear to have the least number of objections. He urges the necessity of greater care in taking samples—an operation which is of equal importance to that of assaying, as regards the value of working results, although the accuracy and attention bestowed on the two operations are widely different. The details of the paper are very numerous but the following guide is suggested in the "quartering down" by the usual method of the original ore sample: that the size limit should be 2 in. cube for a sample of 1,200 lb., 1 in. cube for 300 lb., $\frac{1}{2}$ in. cube for 80 lb., $\frac{1}{4}$ in. cube for 20 lb., $\frac{1}{8}$ in. cube for 5 lb., and $\frac{1}{16}$ in. cube for 2 lb.—A. W.

Zinc Vats in place of Zinc Boxes [Gold, Cyanide]. W. A. Caldecott. Journ. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 161—162.

The chief objections to the usual rectangular zinc boxes are the formation of channels, due to the tendency of the solution to travel up the sides and especially up the corners of the compartments, and the subsequent inconvenience in cleaning up. The author advocates their replacement by small circular vats, which overcome the mechanical disadvantages and contain about one-half more zinc per square foot of floor space. The vats are internally 5 ft. in diameter and 3 ft. in depth, and each contain about 40 cub. ft. of zinc. The solution enters through a pipe at the bottom into a space underneath the zinc, formed by an iron ring 4 ft. in diameter and 4$\frac{1}{2}$ in. high covered with perforated sheet iron, and rises up into and through the body of the zinc and through a top wooden grating into the overflow pipe. This pipe leads back to the supply main on the other side of a shut off tap and the solution flows to the next vat, this arrangement allowing any one vat to be stopped independently for cleaning by opening the tap in the main.

The average results obtained with a recently erected system of two sets of vats of three each and a lead-zinc couple with weak cyanide solution (0·04 per cent.), show that 3 dwt. of gold are reduced to 2·5 grains, or a precipitation of 96·5 per cent. About 85 per cent. of this is precipitated in the first vat with a rate of flow allowing only 15 minutes' contact.—A. W.

Cyanide Poisoning. J. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 168—169.

See under XVIII. B., *page* 1046.

Gold, Precipitation of, from Cyanide Solutions. A. H. Hartley. Journ. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 101—102.

From the results of a few experiments with tailings from a free milling and highly oxidised ore containing a considerable amount of copper, it was found that $\frac{1}{2}$ lb. cyanide per ton was as effective as 4 lb. per ton and that the precipitation of the gold in the zinc boxes was as good without the addition of cyanide at the head of the box as with it. If the zinc was "dead" or inactive, the addition of a small quantity of cyanide, $\frac{1}{10}$ lb. per ton of solution, did not render it active, but caustic soda or a large quantity of cyanide did so. The precipitation of the gold in the zinc boxes is not apparently affected by the previous aeration of the cyanide, and the good results obtained are attributed to the presence of the copper, the co-precipitation of which on the zinc does not depreciate the average fineness, 850, of the bullion obtained from the precipitate with the ordinary fluxes and without any special refining agencies.—A. W.

Cyanide Solutions, Estimation of Protective Alkali in. A. F. Crosse. Journ. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 97—98.

For the estimation of the alkaline material, such as lime, &c., placed in cyanide solutions to protect them from decomposition by free acids and other bodies in the slimes and tailings, the author treats the solution with a definite quantity of pure potassium bisulphate, and determines the free hydrocyanic acid thus formed, the amount indicating the quantity of acidity of the bisulphate not neutralised by the protective alkali. From this can be calculated the amount of lime, potash, or whatever substance is used, which has been neutralised by the acid sulphate. To 500 c.c. of the test solution are added about 2 grms. of pure cyanide to ensure an excess, and then 1 grm. of the bisulphate, the whole being boiled for 45 mins. to distil off the hydrocyanic acid, which is condensed and collected in caustic potash, and its quantity estimated in the usual way by means of decinormal nitrate of silver solution. The process has been proved with known solutions to work in accordance with the theoretical equations.—A. W.

Gold Precipitation by Zinc Dust. G. A. Packard. Journ. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 166—167.

In the adjourned discussion on the above paper (this Journal, 1899, 922) Mr. C. H. Pead gives the results of his experiments, in which cyanide solutions (0·16 per cent.) containing 11 dwt. of gold were shaken with zinc shavings and zinc dust, the former being occasionally and the latter constantly stirred. The precipitation of the gold was in favour of the zinc dust, both as to rapidity and completeness, and moreover the activity of the zinc did not materially diminish after six repetitions of the experiment over a period of six days, using fresh solution each time, with about 24 hours' contact. The value of the present experiments, however, would appear to be diminished by the unequal stirring and by the fact that the shavings and dust were taken in about equal weights and not in equal proportions as to their surface area.—A. W.

Slimes Treatment, Continuous Process of. E. T. Rand. Journ. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 103—105.

This paper contains a description of a slimes treatment, in which the slimes are kept in a constant state of movement. The slimes pulp from the sands settling vat is run into an inverted cone-shaped vessel, with sides at an angle of 55° to 60°, in which the pulp settles and thickens. Clear water flows over the top and back to the reservoir and the thickened pulp runs out at the bottom into a launder, into which also the necessary quantity of cyanide, &c. is poured, the whole flowing over mixing screens into the dissolving-vat. This vat has vertical sides and an inverted cone-shaped bottom, and is provided with stirrers and an outside circulating pump, which draws the mixture out from below and passes it in again at the top. The mixture is then pumped up to the first cone-shaped washing-vat, the overflow gold solution from the top being led into the precipitation boxes, whilst the pulp falling into a launder is washed by the waste water from the precipitation boxes into a second and similar washing vat, the overflow from this running back to the fresh slimes launder leading to the dissolving vat, whilst the spent pulp is passed out to the waste heap. The experiments are tentative, but the results are satisfactory, a three weeks trial with 1,000 tons of pulp, averaging 1·8 dwt., working out at 0·5 lb. of cyanide per ton.

In a discussion on this paper, F. N. Hambly mentions the Clancy continuous slimes process, for which a plant was designed in March 1898 for an 80-stamp mill, and which is very similar, both as regards apparatus and method, to Rand's process. He gives a sketch and short description of the plant, which shows six vats of a slightly different shape to the inverted cone, *viz.* :—vertical sides at the top, then truncated inverted cone, below which the sides are again vertical, with a small inverted cone-shaped bottom. With a 3·5 dwt. slime 85 per cent. of the gold has been dissolved by this process in a preliminary experiment.—A. W.

Stamp Milling [Gold and Silver] Water Requirements for. G. W. Riter. Eng. and Mining J. 1899, **68**, [10], 278.

The author gives figures, covering a period of 27 months, obtained at Eureka Hill, in the Tintic Mining District, Utah, as to the amount of water required to operate the stamp mill. The mill contains 100 stamps, 50 Frue-vanners, 32 pans, 16 settlers, and the necessary agitators, clean-up pans, retorts, furnaces, &c. Power is furnished by a Corliss compound non-condensing engine. As the tailings discharge from the sluice boxes, the water, being brought practically to rest and relieved of suspended matter, is drained off slowly into a sump and pumped back to the mill. In the table given below is represented, therefore, the water supplied from the main reservoir to replace the quantity lost. The ore was crushed through wire screens, 35 meshes to the inch ; it was composed mainly of quartz, so hard that the average stamp duty was less than two tons per day.

Consumption of Water in Gallons Per Ton of Ore.

—	1st Period. 9 months.	2nd Period. 6 months.	3rd Period. 6 months.	4th Period. 6 months.
Total for mining and milling purposes.	591	522	541	625
Proportion for mining purposes.	83	65	..	..
Proportion for milling purposes.	508	457	..	..
Proportion for making steam at mill.	..	128	127	127
Proportion for crushing, concentrating, amalgamating, &c.	..	329	..	..

—A. S.

Silver Smelting, Losses in. M. W. Iles. Eng. and Mining J. 1899, **68**, [11], 307—309 ; [12], 340—341 ; [13], 367—369.

The author gives the results of an exhaustive study of the question of silver losses in smelting at the Globe Smelter, Denver, Colo., U.S.A. The period covered by the investigation was the month of March, 1893, the number of furnace days being 230, and the tons smelted per day per furnace, 60, an amount greater than the usual average. It is possible that the furnaces ran too fast for the conditions that prevailed. The amount of matte produced was high, but not abnormally so, and it may be safely concluded that the silver losses were not due to this cause.

The system of flue dust chambers and bag house is so complete, that losses of silver, lead, and gold, cannot occur through dust and fume.

Roasting.—The amount of ore roasted was 5,556 tons, and the cost, which was less than the average, was 3·417 dols. per ton on the fuse boxes and sinter furnaces, and 2·504 dols. per ton on the Brown roasters. This low cost of roasting was, however, really a source of loss, as the ore was roasted incompletely, with the result that too much raw matte was fed into the blast furnace, and large quantities of silver were lost over the "dump," owing to floating, light zinc matte, together with a shortage of lead on the charge. Ores containing a considerable amount of zinc, such as were met with in this period, require longer and better roasting in order to convert the zinc sulphide into oxide, so that the zinc will pass into the slag as a silicate, instead of into the matte as sulphide, making the latter specifically light. It is shown later that it is important to make as little matte as is consistent with good work, and the amount produced is dependent, to a considerable extent, upon the way the ore is roasted, bad roasting giving rise to much matte. It may be confidently stated that the more zinc ore treated, the better should be the roast, and also the more lead is necessary to wash out the silver from the slags and mattes.

The author gives the advantages of sintering furnaces over fusing furnaces as follows :—(1) cheaper fuel ; (2) less loss of lead and silver in roasting ; (3) the roasted ore contains less sulphur, and hence makes less matte ; (4) no expensive silicious ores are required ; (5) more zinc is expelled, and that remaining is in a better condition for blast furnace work ; (6) large quantities of lead sulphides may be utilised, thereby making less matte in the blast furnaces ; (7) more zinc ores may be used ; (8) less lead is lost in the blast furnace slag ; (9) less silver is lost through float zinc matte. The only disadvantages are the finer state of division of the roasted ore and lower tonnage. However, with the modern large type of furnaces, sintered ore can be successfully handled without a loss of tonnage, since the difference in the state of fineness of the two products (fused and sintered ore) can be overcome by raising the blast. The cost is practically the same, as, although the fuse boxes use a much more expensive coal, the sinter furnaces use a larger quantity of cheaper coal. The size of the charge for the roasters should be dependent particularly upon the percentage of sulphur and zinc in the ore. With small blast furnaces, low blasts, and where the ores to be treated are fine, it is best to fuse the ore in order to get tonnage from the blast furnaces, although this is a sacrifice of silver and lead for tonnage.

Blast-Furnace Charges.—The author states that for the efficient collection and saving of matte, the following conditions must be observed :—(1) Quick and cheap removal of matte and slag from the furnace ; (2) concentration of matte and slag into one large furnace ; (3) maintenance of matte and slag in a perfectly liquid form ; (4) sufficient time for matte to separate ; (5) cheap and quick removal of matte and slag from the central storage tank or furnace.

Although the chief aim should be to produce slag as light and mattes as heavy as possible, yet the viscosity of the products must also be taken into account.

Smelting.—The cost of smelting was 3·402 dols. per ton which is a trifle less than the average. The slags were high in silver (1·45 oz. per ton), but rather low in lead (0·43 per cent.), thus indicating that the silver losses were not due to a shortage in fuel, as the reduction was good. The silver losses are largely determined by the amount contained in the matte, and it is therefore very important to use plenty of lead, in order to produce low grade mattes. Siliceous slags make mattes running high in lead. Silver losses are practically caused by mattes running high in silver and zinc, together with a shortage in the lead supply.

Mattes.—The silica in mattes is wholly dependent upon the care exercised in separating from the slag, since, strictly speaking, matte does not contain any silica as a part of its composition. The more fusible the zinc ores were, the greater was the difficulty in subsequently separating matte from slag. The amount of iron in mattes varies from 30 to 40 per cent.; this amount is also liable to vary in accordance with the quantity of slag retained mechanically. The percentage of iron in a matte decreases as the amount of copper increases. The amount of zinc in mattes varies between 3 and 10 per cent., and is usually dependent upon its condition when entering the blast furnace, whether as oxide or sulphide. It has been proved by experience that when mattes run high in zinc, the percentage of copper should be increased, if possible, in order to lessen the loss of silver through the slags. The amount of manganese in slags varies from 2 to 3 per cent., and is largely due to the slag contained therein. It is stated that manganese materially reduces the amount of matte formed, owing to the oxidation of the sulphur in the ores by manganese dioxide. Sulphur in mattes varies from 15 to 25 per cent., generally, however, from 17 to 20 per cent. The amount of copper varies from 3 to 20 per cent., usually from 5 to 10 per cent. This element makes mattes specifically heavy, hence they settle well, and the more copper a matte contains, the lower will be the amount of silver contained in the slags.—A. S.

Bertrand - Thiel Process [*Iron*], *Explanation of the Rapidity of the.* H. M. Howe. Eng. and Mining J. 1899, **68**, [10], 276.

After a detailed inquiry, the author concludes that the greater rapidity claimed for the Bertrand-Thiel process is due to—

(1.) The greater room available for metal: (*a*) because less slag is formed owing to washing out much of the phosphorus and silicon with a relatively acid slag, and to oxidising by means of gangue-less iron oxide instead of iron ore; (*b*) because, since the first slag is removed, a smaller proportion of the total slag is present, on an average of the whole time.

(2.) The higher temperature, due to highly pre-heating the "pig" and iron oxide before their reciprocal action begins.

(3.) The greater fluidity resulting from the higher temperature of metal and slag, the small quantity of final slag and possibly, the larger ratio of iron oxide to lime in that slag.—A. S.

Zinciferous Lead Ores, Furnace for Smelting. L. Kloz. Eng. and Mining J. 1899, **68**, [10], 279.

The author gives a description of a furnace used at Playa Blanca, Chile, for smelting an ore of the following average composition:—SiO_2, 20; Fe, 20; S, 30; Zn, 18; Pb, 7; Cu, 1; Sb, 1 per cent.; small amounts of tin and arsenic, but no bismuth. The rusting of the furnace stack cannot, of course, with the large proportion of zinc, be altogether avoided, but the stops for "barring down" have been reduced to a very short time, and in combination with a removable crucible, it has been found easier to stop the furnace altogether, clean it out, and start afresh, which can be done within 24 hours. As cast-iron jackets are of such poor quality as to be unserviceable, and wrought-iron jackets besides being very expensive, need frequent repairs, if a mixture of salt and fresh water be used, the author constructed a new form of jacket by means of "gas pipes, 1 in. diameter, of best quality, bent into a zigzag form and put into a sand-mould to receive an iron casting around them." Such jackets, if properly made and of a good quality of pipe and cast-iron, are stated to be nearly unbreakable. They need less water than the ordinary water jackets, and the regulation of the water is of little importance.

The stack of the furnace rests upon pillars, and is made of jackets of the construction already described, but shaped to suit the form of the furnace. The upper jackets need very little water in "starting up" the furnace, whilst as soon as a crust is formed, they do not need any water. Above these jackets and about 8 ft. above the tuyères, in furnaces running with a moderate blast—say, 24 ins. of water—simple cast-iron plates are used in place of jackets. The tuyère jackets are fastened and suspended from the upper jackets, so that the crucible is entirely free.

The crucible consists of a cast-iron bottom plate, 2 ins. thick, with a rim; and six side plates, each three of them being lightly bolted together at the corners, leaving spaces free in the centre on both long sides, in which the tap holes are located. The crucible rests upon a car provided with jack-screws, by means of which it can be raised and lowered. After being put into its place beneath the furnace, the car is screwed up until the crucible is in its proper position, where it is secured, and then the car is retired, leaving an open space under the crucible.

The method of working is as follows: A small fire is started in the crucible to dry it out; coke is added from above, and by introducing air pipes through the tap holes, the fire is soon rendered glowing. More coke is charged, until it reaches about 2 ft. above the tuyères. A few slag charges with a good amount of bullion or litharge are thrown in, and after filling up the furnace with the regular charge, smelting is proceeded with as usual. Slag and matte run through the tap hole, and are separated by overflow pots, whilst at intervals the lead is tapped from the crucible. With a charge containing about 17—18 per cent. of zinc, a furnace will run 2—3 months before the rusting has progressed so far that "overfire" cannot be any longer avoided. The "barring down" is done in the usual manner. As soon as the charge is down, the car is run underneath the crucible, the latter liberated from its resting plates, lowered down by means of the screws of the car, the front packers taken out, and the whole wheeled out. The "barring" of rust in the stack is proceeded with immediately, and by cutting out first the middle of the sides, the rust will slip down as a whole to the foot of the furnace, where it is cooled by water, broken into pieces, and removed. A new crucible may be run into the furnace and smelting resumed.—A. S.

Copper Mattes in the Bessemer Converter, Treatment of. J. Douglas. Inst. of Min. and Met., Oct. 25, 1899.

This paper gives a short historical sketch from its inception in 1866, 10 years after Bessemer's first patent, to the present time. It describes the experimental work of Holloway, who attempted to combine the operations of smelting and converting in the one furnace, and the development of the Manhès process, which was at first carried out in two separate converters and the primary success of which was due to the fact that the tuyères, instead of being situated at the bottom of the converter and becoming clogged by solidifying copper, were placed at the side surrounding the molten bath. Compared with the Bessemerising of iron there is a much greater amount of material to be oxidised, 75 per cent. having to be disposed of in a 25 per cent. matte instead of 5 to 10 per cent. in making steel, and this constitutes the chief difficulty of the process. Moreover, the heat generated by the oxidation of silicon and carbon is nearly four times greater than that generated by the same weight of iron and sulphur, although copper has the advantage over iron in its lower specific heat. Manhès, in his first converter, concentrated the matte to 60 per cent., and in the second he completed the reduction to metallic copper, adding silica and sometimes a little ferro-manganese to prevent the formation of thick slags. He found that lead, zinc, and tin oxidised readily, and arsenic and antimony with more difficulty, yet their removal was complete and the resulting copper almost pure. The various practical developments are then described, including the important introduction of punching through the tuyères, to keep them free from copper, and the modification of the process for the recovery of the precious metals.

There are now in use four types of converters: 1st, the circular upright converter with elevated tuyères; 2nd, the upright converter with square body and trough-shaped bottom, designed by Stalmann; both these revolve on trunnions; 3rd, the horizontal trough or "barrel" converter, resting and revolving on rollers; and 4th, the David "Selecteur," or oval upright converter, with bottom tuyères and protruding side pocket, in which to collect the first copper formed, which contains the gold and silver. The David converter or selecteur (this Journal, 1898, 1150) has reverted to the bottom tuyères but they are constructed obliquely, so that the charge rotates in blowing and the punching is readily accomplished, the operation in this form being less destructive to the converter lining. The future development of the process will tend to the inclusion of both smelting and reducing in one furnace, although beset with many difficulties, including those of relining and of the disposal of gases which clog the flues, &c. Large reverberatory furnaces are now being built for smelting the ore into matte and then Bessemerising it without removal, in which form some of the converter objections are minimised.

The lining of the converter wears very rapidly, and constitutes the chief source of silica for the slag. Silica has been blown through the tuyères and supplied through the converter mouth, but with no satisfactory result, as most of it remains unacted on. A lining, with patching, will stand through only four charges of a 45 to 50 per cent. matte, and is usually consumed at the rate of about one-half of the weight of copper produced. It is usually very acid, chiefly quartzite, with frequently a backing of magnesia bricks to prevent the charge piercing to the shell; but in some places suitable ores, rich in silica, and containing small quantities of iron and copper, are used, in this way adding their copper contents to the charge. Mechanically made linings seem to last longer than hand laid.

The charge is invariably matte, which may widely vary in percentage, no attempt being now made to smelt ore unless it is also useful as a lining. Any matte can be employed, but the more iron it contains the shorter is the life of the lining, and, unless this is made up of an ore containing precious metals which it is desired to recover, the treatment of too low a grade of matte is unadvisable. A 50 per cent. matte is a good working grade. The first blow lasts 20 minutes, during which the iron is oxidised and converted into slag, and half the sulphur is burnt, the remainder, with the copper, forming white metal. The slag is poured off, and more matte added, blown, and cleaned, to get, if necessary, sufficient white metal to be well above the tuyères. The white metal is then blown with the production of copper of about 99 per cent., which is cast into moulds or into plates for anodes. The duration of the blow is regulated by the colour and the peculiar noise of the escaping gases and the appearance of the solid particles ejected. As a rule, it is only when the metallic copper begins to form that the all-important punching of the tuyères has to be commenced. During the first blow the whole of the matte and slag are liable to be suddenly ejected from the converter. This is attributed primarily to the production of too thick a slag, under which the blast accumulates, producing oxide of copper, which reacts with the sulphide, yielding a high pressure of sulphur dioxide. The largest converter is at Aguas Calientes, in Mexico, and is 8 ft. in diameter. Three or four charges of matte, totalling about 45,000 lb., are blown in this, and the accumulated white metal converted into about 8,000 lb. of copper.

It would appear that all the iron is removed in the first blow except about 0·15 per cent., which is afterwards found in the copper, and that nickel is more rapidly oxidised in the converter than in the cupola or the reverberatory furnace. Judging from the analyses of the matte and copper, the loss of silver was 4·6 per cent. on 8·6 oz. per ton of copper, and the loss of gold was 8·2 per cent. on 0·429 oz. per ton of copper, although one case is cited which shows a gain in both precious metals; in this case the loss of copper being in greater proportion. In this direction, the David Selecteur, with its pocket or side tap-hole for removing the first formed copper or bottoms containing the bulk of the gold, &c., has a distinct claim to advantage. It appears that selenium and tellurium show a preference for remaining in the unconverted sulphide, and do not concentrate in the bottoms, the final copper bars containing the greater proportion of these elements. The slag varies from 1 to 5 per cent., or, on an average, about 2·5 per cent. of copper.

The cost is widely variable, and, in America, probably lies between 0·607 cent per lb., the price at Anaconda, and 0·360 cent per lb., the French price with the David Selecteur. The cost of producing one million pounds of copper per month from one converter can be calculated from the following requirements:—110 h.p. consumption or 5 tons of coal per day for blowing engines; 250 tons of clay and quartz, and 1,000 days' labour, including superintendence, and allowing a high wage for intelligence and skill. There is a loss of copper of about 2—3 per cent., although scarcely any appears to be volatilised, and if zinc and lead be present in any quantity, there is a considerable loss of silver.

The reactions are complicated, and are not yet thoroughly worked out, but the reaction-reduction of the reverberatory process takes place with the formation of both di- and trioxides of sulphur. The temperature reaches its maximum during the rapid oxidation of the iron and the partial oxidation of the sulphur, after which it falls and remains nearly stationary. At present, the converter annual output in the United States is 350,000,000 lb. of copper, 9,000,000 oz. of silver, and 30,000 oz. of gold. A table of curves, a general plan of the Anaconda plant, drawings of the David Selecteur, an elevation and plan of a general converter plant, and photo-reproductions of the Stalmann, Parrot, and Bisbee converters, and of two hydraulic transfer cars, accompany the paper.—A. W.

Antimony in Brass. E. S. Sperry. Eng. and Mining J., 1899, **68**, [11], 306.

The author states that the occurrence of cracks during the rolling of brass is due, in some cases at least, to the presence of impurities in the copper of the alloy. Quantities of antimony varying from 0·01 to 0·65 per cent. were added to a brass composed of 60 per cent. of "Lake copper" and 40 per cent. of zinc, and the alloys obtained were examined as to their behaviour in the rolling mill. It was found that when the percentage of antimony reached as much as 0·02, its presence was indicated by the fracture of the rolled metal.—A. S.

Alloys, Corrosion of, by Sea Water. Imp. Inst. J., Nov. 1899, 293; through Scient. American, **81**, 35.

Details are given of an investigation conducted by the German Admiralty for determining the action of sea-water upon alloys.

Copper, zinc, tin, aluminium, and iron-aluminium bronzes were the metals used for the experiments, and for every test, 12 strips of each alloy were employed. Nine of these were immersed in sea-water, and the remaining three reserved as standards. The duration of each experiment was two years, and at the end of every eight months, three strips were withdrawn from the water, and their physical properties tested and compared with those of the standards. In this way any deterioration of the alloy during stated periods was determined.

The results of several experiments may be summarised as follows:—

It was found that the iron, tin, and aluminium bronzes had deteriorated very little. There was no marked difference in their appearance, weight, or strength, even after from two to two and a half years' immersion.

When iron and tin bronzes were in contact, a serious alteration in the qualities of the former was noticed, and one specimen after two years' immersion lost two-thirds of its strength, four-fifths of its elongation, and was partially destroyed by the solution of the zinc. Cast and wrought bronze were found to behave similarly, and a wrought plate of iron-bronze in contact with a cast plate of the same material lost 60 per cent. of its tenacity in two years.

The conclusion deduced by the Admiralty from these tests, is that the corrosive action between different metals, depends upon their relative position in the electrical scale. Thus, pure aluminium bronze is practically proof against the action of sea-water when in contact with metals which are electro-negative towards it. It is, however, quickly destroyed when in contact with an electro-positive metal. Hence, when metals and alloys are subjected to the action of sea-water, only those metals should be placed in contact which are near to one another in the electrical scale.

Experiments on the deterioration of certain alloys due to the action of the atmosphere were also conducted, and it was proved that whilst iron bronze suffered practically no injury, the alloys which contained a large proportion of zinc were easily corroded.

Copper with Zinc, The Heat of Combination of. T. J. Baker. Proc. Chem. Soc. **15,** [213], 195.

The only work in this direction hitherto appears to be by Dr. Galt (Rep. Brit. Ass. 1898, and Proc. Roy. Soc. Edin. 1899) and by Herschkowitsch (Zeit. f. phys. Chem. 1898, **27,** 123). Neither appeared until this work was nearly completed, and in each case the number of observations appears to have been small. In the present research, the method consisted in the determination of the difference between the heat of solution of an alloy of the two metals and that of an equal weight of a mixture in the same proportions. Actual determinations of the latter quantity were made, as it was not found possible to calculate it exactly from the heat of solution of the separate metals.

Two solvents were used. (*a*) Chlorine water (0·15 normal). (*b*) $HNO_3,3H_2O$.

Only alloys with less than 42 per cent. copper could be so finely powdered as to dissolve quickly in chlorine water. With nitric acid as solvent, a series of 21 alloys (all made from the purest metals obtainable and carefully analysed) was examined. The results obtained by both methods agree very well.

The results are expressed in the form of a curve with percentages of copper as abscissæ and heats of formation of 1 grm. of alloy as ordinates. From 0 to 30 per cent. of copper, no heat of combination could be detected. This renders doubtful the existence of the supposed compound, $CuZn_2$ (Laurie, Charpy, and Herschkowitsch).

From 30 to 62 per cent. of copper, the curve rises to an ill-defined maximum of 46 calories per grm. of alloy. This alloy (62 per cent. copper) does not correspond to any simple atomic compound, but is otherwise remarkable (see 4th Report of the Alloys Research Committee, Institution of Mechanical Engineers).

From 62 per cent. copper onwards, the curve gradually sinks to zero at 100 per cent. copper.

Hence copper and zinc evolve heat when alloying with one another, a point of interest with reference to the electro-deposition of brass.

Magnesium, A New Volumetric Method of Determining. R. K. Meade. J. Amer. Chem. Soc. 1899, **21,** [9], 746.

See under XXIII., *page* 1054.

Aluminium, A New Method for the Direct Determination of, in the Presence of Iron, Manganese, Calcium, and Magnesium. W. H. Hess and E. D. Campbell. J. Amer. Chem. Soc. 1899, **21,** [9], 776.

See under XXIII., *page* 1053.

Zinc, Electrolytic Determination of, in Presence of Manganese. E. J. Riederer. J. Amer. Chem. Soc. 1899, **21,** [9], 789.

See under XXIII., *page* 1054.

Bronzes, Analysis of. A. Fomin. J. russ. phys.-Chem. Ges. **31,** 565.

See under XXIII., *page* 1052.

Alloys of Tin, Antimony (Arsenic), Lead, and Copper; Analysis of. E. Prost. Bull. Assoc. Belge des Chim. **13** [7], 323.

See under XXIII., *page* 1053.

Zinc Oxide at High Temperatures, Behaviour of. R. C. Schüpphaus.

See under New York Section, *page* 987.

Antimony, Determination of, in Ores. T. Brown, jun. J. Amer. Chem. Soc. 1899, **21,** [9], 780.

See under XXIII., *page* 1052.

PATENTS.

Blast and Cupola Furnaces. A. Reynolds, Sheffield. Eng. Pat. 22,182, Oct. 21, 1898.

The tuyères slope downwards towards the well of the cupola or blast furnace, and are connected to, and supplied with the gas from a gas producer or other convenient gas supply. Inside each tuyère is a pipe of smaller diameter connected with an air-pump or other air supply under pressure, but preferably to the same main as that which supplies air to the gas producer, the whole being capable of regulation by valves, so that the proportion of air and gas passing through the tuyères can be properly adjusted.—A. W.

Furnaces for Smelting and other Purposes, and in Gas Generators therefor. J. Terény, of Zolyom Brezo, and B. Uhlyarik, of Budapest, Hungary. Eng. Pat. 7723, April 12, 1899.

The inventors employ, for the formation and heating of the gaseous fuel used, two generators, either of which alternately can be utilised as a gas producer whilst the other serves to heat and purify the gas so produced. A grate agitating device is also provided "wherein the agitating of the movable grate bars is caused by turning in any suitable manner a shaft carrying cams in operative connection with said bars"; together with an air heater "constructed of clay plates or the like, which form air and smoke channels alternately through which alternate channels the smoke gas, and air pass at the same time, but in opposite directions means being provided whereby the air heater can be cleaned during action."—C. S.

Precious Metals, Extraction of, from Ores, Slicks, or Metalliferous Residues, and the like. S. Kurovsky, Zalathna, G. Gschwandtner, Selmeczbánya, and H, Schuster, Arad, all in Austria-Hungary. Eng. Pat. 19,168, Sept. 8, 1898.

This patent is for treating materials containing precious metals, more especially ores, slags, &c. containing gold, wherein the material is mixed with common salt and roasted, either in a self-heating furnace with the aid of heat generated by the burning sulphur of the ore, or in an ordinary flame furnace. The roasted product is then lixiviated with a solution of common salt, or of hot water, to extract the metallic chlorides, and the solution repeatedly passed over iron chips or fragments, preferably in "such a manner that the said liquid leaves the cementing layers, formed of pieces of iron, at the lower third of the said layers."

The roasted products may be washed out, either before or after the lixiviation, by first a stronger, then by a weaker solution of cyanide salts, and finally by water. The cyanide solutions, and, if suitable, the wash-water so obtained are then repeatedly passed through zinc chips or fragments to remove the metal, preferably in "such a manner, that the liquid will leave the layers formed of these chips or fragments of zinc at the lower third of their depth."—A. W.

Complex Ores, Treatment of. G. de Bechi, Paris. Eng. Pat. 23,221, Nov. 4, 1898.

The complex ore is roasted in one chamber or receptacle and an alkali chloride salt in another, steam in suitable quantity being injected into each. The sulphurous fumes from the former are led into and passed over the salt in the latter, whereby the sulphate is produced, the escaping acid, chiefly hydrochloric, being condensed and utilised in lixiviating the roasted ore. The metals in solution are separated and recovered by "fractional precipitation."

Pyrites may also be roasted with the ore, or separately, to provide sulphurous fumes if these be deficient.—A. W.

Ores, Treatment of, and the Precipitation of Precious Metals from their Cyanide Solutions. F. W. Martino and F. Stubbs, both of Sheffield. Eng. Pat. 4925, March 6, 1899.

In furtherance of a previous patent, the present claims are for the employment of a metallic carbide and a hydrocarbon gas, with the exception of calcium carbide and acetylene, such, for instance, as aluminium carbide, which with water ields methane, in the treatment of ores or tailings containing the precious metals; and for the employment of the gas, with or without air, and of the carbide, in conjunction with the cyanide solution, for the precipitation of the precious metals therefrom. Furthermore, the finely-divided ores or tailings may be mixed with the metallic carbide and moistened, to set free the gold, &c.—A. W.

Gold, Precipitation of, from Chloride or Bromide Solutions containing it. F. W. Martino and F. Stubbs, both of Sheffield. Eng. Pat. 5034, March 7, 1899.

To precipitate gold from chloride or bromide solutions, a metallic carbide, such as calcium, barium, or aluminium carbide, and a hydrocarbon, such as acetylene or methane, are employed in a convenient manner (see preceding abstract).—A. W.

Gold, Silver, and other Metals, Extraction of, from Ores and the like. J. B. de Alzugaray, Shortlands. Eng. Pat. 21,395, Oct. 11, 1898.

In this specification there are nine claims for the extraction of precious metals from ores by means of gaseous cyanogen, bromine, and oxygen, together or in part, and of concentrated cyanide solution, bromine and oxygen, also together or in part. The crushed ore is moistened with the cyanide solution, placed in a gas-tight vessel, and subjected to the action of a gaseous mixture of bromine and oxygen, whereby the precious metals are converted into soluble salts, which are then extracted with water, and submitted to electrolysis or any other well-known method of precipitation. The ore may be moistened with water and subjected to a gaseous mixture of cyanogen, bromine, and oxygen in the gas-tight vessel, and afterwards similarly extracted with water, &c. for the recovery of the precious metals.—A. W.

Iron, or other Ores, Treatment of, in Blast Furnaces and the like. L. H. F. Pugh, Paris. Eng. Pat. 22,441, Oct. 25, 1898.

The improvement consists of the injection, into the air-blast, of a hydrocarbon or any gas or liquid exercising a reducing action and applied as a gas or spray. The apparatus for this purpose consists of a vertical cylindrical chamber fitted "with injectors or burners for the hydrocarbons to any number," the chamber communicating at its base with the hot-air supply duct from the stove, and at its upper end with "pipes leading the air to the tuyères by means of valve boxes which permit the apparatus to be disconnected at will from the hot-air ducts." Furthermore, the cylindrical chamber may be omitted, and the injectors or burners for the hydrocarbons applied to hot air (Cooper-Siemens) apparatus at the back of the tuyères, or at any other suitable points in the hot-air pipes of blast or similar furnaces.—A. W.

Iron and Steel, Manufacture of, and Apparatus therefor. W. Ivanoff, St. Petersburg. Eng. Pat. 24,749, Nov. 23, 1898.

In the manufacture of iron and steel, crude fuel (wood, coal, &c.) is used and is kept separate from the ore. It is treated in a specially constructed furnace, which consists of an upper chamber, in which carbonisation takes place, and a lower chamber into which the carbonised material is occasionally allowed to fall by means of a closable valve between the two. In the lower chamber it is partially burnt to carbon monoxide by a hot-air supply, or by the mixture of carbon dioxide and oxygen from the converter. The resulting hot inflammable gas is then led to the tuyères of the blast furnace in which the ore and flux are smelted. The volatile gaseous distillation products from the upper fuel chamber are separately utilised for heating air or for boiler purposes.

The cast iron is run or ladled into a rotatory converter supported on independent rollers, the trunnions serving simply for the air supply on the one side and for the gaseous oxidation products to escape on the other. These gases are led to the fuel chamber, in which the converter splashings are also collected. Any sulphur in the fuel is eliminated by introducing iron, manganese, lime, or alkalis into the fuel chamber, or conduit therefrom, and the blast furnace is provided with a movable vertical central tube, through which solid fuel may be passed down to the ore mixture at any desired level. These points are included in five claims, each one with subsections varying in number from two to six.—A. W.

Lead, Tin, Copper, and other Metals or Metallic Alloys with a view to Prepare Oxides in a Pulverulent State, Process of Treatment of. C. L. C. Bertou, Paris. Eng. Pat. 25,477, Dec. 2, 1898.

To prepare the oxides of metals and metallic alloys in a pulverulent state, the metal or alloy, previously reduced to a fine powder, is mixed with a sufficient amount of air to cause oxidation, and heated or ignited, the resulting fumes being maintained "for a certain time in contact with air in a highly heated chamber, so as to complete (or supplement) oxidation if need be." The method of ignition may consist in injecting the mixture on or into the kindling flame, or projecting it against a highly heated surface.—A. W.

Cupric Sulphate Solution, Treating. O. Hofmann, Argentine, Kansas, U.S.A. Eng. Pat. 13,320, June 27, 1899.

Crude cupric sulphate solutions, such as are obtained by treating roasted sulphuretted copper ore with dilute sulphuric acid, are made as nearly neutral as possible, and are heated with addition of cupric oxide while air is injected, for some hours. The ferrous sulphate contained in the liquor is thus oxidised, and ferric hydroxide is precipitated, with other impurities. The liquid is now, after filtration, stated to be free from iron, arsenic, antimony, nickel, and cobalt, and can be directly subjected to evaporation for the manufacture of blue vitriol. Some basic copper sulphate separates with the impurities, and is dissolved out by treatment with very dilute acid. Roasted matte, in a state of fine division, may advantageously replace cupric oxide in the purification process.—E. S.

Aluminium and Magnesium Alloys, Manufacture of. A. G. Brookes, London. From P. Aulich, Berlin. Eng. Pat. 14,226, July 10, 1899.

This is a process for the production of aluminium and magnesium alloys, its main feature being that the alloys are separated direct from aluminium and magnesium compounds suitable for the purpose, proper chemical reducing agents or electrical current being used at the same time; or, aluminium produced separately is added to the given magnesium compound in the course of the production of magnesium, or forms the cathode in the electrolytic process; or, the magnesium produced separately is added to the given aluminium compound in the course of the production of aluminium, or forms the cathode in the electrolytic process. Antimony is to be added to the aluminium either before or after such addition or, finally, when aluminium is added to a magnesium compound, for the purpose of preventing the rising of the magnesium, its evaporation, and its reunion with the electro-negative constituent. Eng. Pats. 24,878 of 1898 and 5225 of 1899 are referred to (this Journal, 1899, 770).—J. C. R.

Erratum.—This Journal, 1899, 922, col. 1, line 23 from top: for "G. A. Pacard" read "G. A. Packard."

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A*.)—ELECTRO-CHEMISTRY.

Solid and Molten Electrolytes, Electromotive Force necessary for the Decomposition of. C. C. Garrard. Zeits. für Elektrochem. 1899, **6**, [13], 214—216.

Water (this Journal, 1898, 462—464) has two decomposition points, *viz.*, at 1·08 V. and at 1·67 V., according to the equations—

$$(a.)\ H_2O = \overset{-}{HO} + \overset{+}{H}$$

$$(b.)\ \overset{-}{HO} = \overset{--}{O} + \overset{+}{H}.$$

The first of these is reversible, and corresponds to the electromotive force of the gas battery.

Similarly, the halogen compounds of divalent metals like lead, cadmium, &c., have two decomposition points according to the general scheme—

$$MR_2 = \overset{+}{M}R + \overset{-}{R}, \text{ and } \overset{+}{M}R = \overset{++}{M} + \overset{-}{R}.$$

The following points were observed :—

Substance.	Temperature.	Decomposition Point.	
		First.	Second.
	° C.	Volt.	Volt.
Lead iodide	495	0·396	0·705
„ chloride	608	0·850	..
„ „	638	..	1·254
Cadmium chloride	563	0·715	1·225
„ bromide	591	0·620	0·910
„ iodide	468	0·515	0·680

Just as, in the case of water, the first point of decomposition is reversible and corresponds to the heat of formation of water, according to Helmholtz' theorem—

$$E - Q = T\frac{dE}{dT}$$

where E is the reversible electromotive force of decomposition, Q the heat of formation of the substance, T the absolute temperature, and $\frac{dE}{dT}$ the temperature coefficient; so also in the case of fused salts the first point is reversible.

The following table contains a comparison of the heat of formation of some substances calculated by Helmholtz' formula with those directly observed :—

Substance.	Temperature.	$\frac{dE}{dT}$	Heat of Formation	
			Calculated from $Q = E - T\frac{dE}{dT}$	From Thermo-Chemical Data.
First Decomposition Point.				
	° C.		K.	K.
Lead iodide	495	$-7·7 \times 10^{-4}$	456	446
„ chloride	608	$-8·9 \times 10^{-4}$	755	757
Second Decomposition Point.				
Lead iodide	495	$-6·2 \times 10^{-4}$	546	446
„ chloride	634	$-8·0 \times 10^{-4}$	915	754

Where there are two decomposition points, Helmholtz' theorem applies therefore only to the lower (reversible) point.

The next two tables contain the electromotive force necessary to decompose the fused salts of monovalent metals and the corresponding comparison of the heats of formation.

The agreement is good except in the case of silver iodide, where there is some doubt as to the accuracy of the thermochemical data.

Fused lead bromide formed an apparent exception, but this was traced to the action of the bromine on the carbon electrodes.

Substance.	Temperature.	Decomposition Point.
	° C.	Volt.
Potassium iodide	674	0·833
Sodium „	650	0·812
Silver chloride	560	0·752
„ bromide	566	0·469
„ iodide	564	0·348

Substance.	Temperature.	$\frac{dE}{dT}$	Heat of Formation	
			Calculated from $Q = E - T\frac{dE}{dT}$	From Thermo-Chemical Data.
	° C.		K.	K.
Silver choride	560	$-6·5 \times 10^{-4}$	298	281
„ bromide	597	$-7·3 \times 10^{-4}$	252	252
„ iodide	646	$-6·5 \times 10^{-4}$	203	182

The same methods apply to solid electrolytes, such as silver iodide, which, at a temperature of 465° C., requires an E.M.F. of 0·500 volt.

The second irreversible points in the case of fused zinc chloride and zinc bromide were also determined.

	Volt.
Fused zinc chloride at 467° C.	1·505
„ „ bromide at 504° C.	1·210

—J. S.

Electrolytic Dissociation and Heat of Neutralisation. W. Vaubel. Chem. Zeit. 1899, 23, [75], 764—765.

On the assumption that the molecular weight of liquid water is $(H_2O)_6$, the author puts forward a theory to explain why the heat of neutralisation of acids by bases is in general 137 *k* (*k* = 100 g. cal.), whereas the direct combination of hydrogen and oxygen, not in the ionic state, to form water, evolves 683 *k*. The electrolytic decomposition of water at 0·59 V. (see this Journal, 1898, 462—464) is also discussed.

—J. S.

Hydrochloric Acid, Electrolysis of. Haber and Grindberg. Zeits. anorg. Chem. 16, 198—228, 329—361, 438—449.

The electrolysis of hydrochloric acid of various degrees of concentration between platinum electrodes at the ordinary temperature is the subject first considered. With the concentrated acid, chlorine is evolved at the anode in theoretical quantity, and the amount decreases on dilution until only a small percentage is formed. Traces of hypochlorous acid are formed in the electrolysis of the dilute acid. Chloric acid, to the extent of one-third of the theoretically possible yield, is produced when acid of normal to one-third normal strength is used; it is accompanied by traces of hydrogen peroxide. With very dilute acid, perchloric acid in one-fourth of the theoretical yield is produced. Oxygen is also evolved at the anode, amounting to 40 per cent., in dilute acid. The results obtained are discussed theoretically from the point of view of the ionisation hypothesis.

In the second part of the paper the authors examine the behaviour of the acid when partially neutralised by the addition of bases, and the influence of temperature on the course of electrolysis is studied. The presence of bases, contrary to anticipation, appears to have little influence on the quantity of oxygen obtained from dilute acids. Heating the acid increases the yield of oxygen and decreases that of chloric acid.

The third paper deals with the conditions influencing the corrosive action of the acid on the electrodes. At the ordinary temperature, platinum electrodes are unattacked by acid of less than 30 per cent. strength, whereas at the boiling point some solvent action is observed with 11 per cent. acid. Platin-iridium containing 25 per cent. of iridium, is unattacked by the hot, strong acid, and that containing 10 per cent. of iridium is but slightly attacked. During electrolysis the formation of platinum black is observed at the cathode. This is not due to transference from the anode, since the cathode suffers a loss in weight. A similar action is noticed in the case of lead, and it is possible to obtain a spongy lead cathode, although of comparatively small capacity, by the electrolysis of sulphuric acid between lead electrodes.

Iron Anode, Dissolving, in a Solution of Sodium Acetate and Acetic Acid. G. Arth. Bull. Soc. Chim. 21, [16—17], 766—768.

When iron forms the positive plate of a cell it goes into solution in the ferrous state, even though the liquid be a powerful oxidiser like aqua regia. When, however, iron forms the anode in an electrolytic cell, the electrolyte being a solution of 50 grms. of sodium acetate and 50 grms. of glacial acetic acid in a litre of water, the iron alters its behaviour according to the current sent through the cell. With a voltage below 1·35 and a current (in the author's apparatus) below 0·36 ampère, the iron dissolves to a ferrous salt; but with 2·2 to 3·5 volts and 0·2 to 0·4 ampère, the iron sometimes assumes the passive condition and remains unacted on, and sometimes dissolves directly to a ferric salt. The author is investigating the conditions under which each of these actions occurs.—J. T. D.

PATENTS.

Galvanic Batteries [Dry]. E. Baresch, M. A. Baresch, E. M. Tosler, and W. von Zabern, Vienna, Austria. Eng. Pat. 22,115, Oct. 20, 1898.

Thirty-three parts by weight of powdered coke or gas carbon are intimately mixed with 30 parts of peroxide of manganese, and are saturated with about 20 parts of sal-ammoniac to which a little nitrate of ammonia has been added. The firm mass thus produced is charged under pressure into a bag of woven seamless hose piping around a carbon electrode, perforated with a hole through which passes a string securing the mouth of the bag. The carbon electrode thus formed is placed inside a zinc cylinder containing some porous substance, such as sawdust, impregnated with a solution of sal-ammoniac.—G. H. R.

Electrical Accumulator Batteries. E. Placet, Paris, France. Eng. Pat. 16,636, Aug. 16, 1899.

The plate consists of a support coated with a paste composed of one or more of the oxides of lead mixed with glycerin, to which may be added, to secure increased porosity, some powdered inert material, which can either be dissolved or volatilised out of the formed plate. The support may consist of a perforated or channelled sheet of ebonite, celluloid, gutta-percha, linoleum, wood, paper, cardboard, asbestos, earthenware, or carbon, or it may be formed of felt, cloth, horsehair, or other tissue saturated throughout its thickness with paraffin, bitumen, caoutchouc, "silicate," marine glue, or other substance that will protect the material from decay and from being attacked by the electrolyte. Lighter plates may be formed by employing as the support wire gauze folded on itself, both the outer surfaces and the spaces between the folds being filled with the paste.—G. H. R.

Electric Batteries. H. Blumenberg, Wakefield, New York, U.S.A. Eng. Pat. 19,445, Sept. 13, 1899.

In batteries of the lead-zinc type, aluminium trisulphate is added to the electrolyte with or without the addition of an equal proportion of a bisulphate of the metals of the alkalis or alkaline earths, such as potassium, sodium, or ammonia. In cells containing a metallic peroxide the electrolyte consists of aluminium trisulphate and a sulphate of a metal of the alkalis or alkaline earths in about equal proportions.—G. H. R.

Electrical Conductors and Anodes for Electrolytic and similar Purposes [Non-corrodible Junction]. The General Electrolytic Parent Company, Ltd., L. Hargreaves, and W. Stubbs, Widnes. Eng. Pat. 9631, May 8, 1899.

The object of this invention is to protect the conductor and its junction with the anode from the action of the electrolyte, and this is effected by saturating the anode at or near its junction with the conductor with oil, and by the interposition of casings containing oil, or its equivalent, or oil-saturated material. The connection between anode and conductor is made by blocks of carbon passing through non-conducting casings, and the method of securing the anodes to the conductors is described.—G. H. R.

Electrodes, Elastic and Permeable, for Storage Batteries. L. Tobiansky, Brussels, Belgium. Eng. Pat. 13,826, July 4, 1899.

The supports of the electrodes consist of bags made of an elastic tissue woven of threads of pure gold or platinum, or of gilded or platinised wire, the sides being stiffened by a wire or frame, and the ends of the threads are united and form one of the terminals of the cell. Or the metal threads may be combined with or crossed by non-conducting elastic threads, strips or bands of caoutchouc, gutta-percha, or leather. These bags are filled with a paste of lead oxides rendered permeable by the admixture with it of certain vegetable materials, which are washed out of the mass by electro-chemical action, or which are converted into spongy cellulose or charcoal.—G. H. R.

Electrical Insulation, and also for many Purposes for which Ebonite, Wood, and such like Materials are used; New Material Adapted for. A. Smith, Brockley, Kent. Eng. Pat. 16,247, Aug. 9, 1899.

This new material is produced by mixing acetic aldehyde, or acetic paraldehyde, or polymerised formic aldehyde, with methylated spirit, carbolic acid, and fusel oil, or methylated spirit which has been saturated with hydrochloric or sulphurous acid gas. The product may be moulded and saturated with paraffin.—S. K.

Ozone, Apparatus for Generating. Baron H. Tindal, Amsterdam. Eng. Pat. 24,543, Nov. 21, 1898.

"Apparatus for the [electrical] generation of ozone, comprising a semi-cylindrical metallic vessel having inlet and outlet for gases, a dielectric layer upon its concave surface, a glass plate resting upon and closing said vessel, a series of semicircular metallic discs depending from said glass plate, and electrical connections to said vessel and discs."

According to the inventor, better manufacturing results are obtained if cooling of the gases be disregarded, and care only be taken that the ozonised gas passes through an extended even and dense discharging field. On this principle the present construction of apparatus is based. —J. C. R.

Electrolytic Decomposing [Alkali Salts] Apparatus. Colonel T. J. Holland, Tunbridge Wells, and A. P. Laurie, Loughton, Essex. Eng. Pat. 5199, March 9, 1899.

The following is claimed:—"Electrolytic apparatus consisting of an outer tank divided at intervals by transverse metal plates forming the cathodes; a series of closed porous boxes arranged between the said plates and containing the anodes; means for supplying salt to the anode cells, for maintaining the strength of the electrolyte therein, without opening the cells; means for leading off the gases liberated in such cells; and means for supplying and withdrawing solution to and from the outer tank, whether continuously or at intervals; all arranged and operating substantially as described."—J. C. R.

Porous Diaphragms for Electrolytic Processes, Manufacture of. Colonel T. J. Holland, Tunbridge Wells, and A. P. Laurie, Loughton, Essex. Eng. Pat. 5200, March 9, 1899.

According to this invention, the inventors propose to mix with the cement [for porous cement diaphragms] a volatile material insoluble in water, but which may be removed by converting it into vapour after the cement has been set. Such a material is naphthalene or anthracene, about 20 per cent. of which may be added in a crystalline powdered state to the dry cement, and afterwards volatilised by means of heat.—J. C. R.

(*B.*)—ELECTRO-METALLURGY.

PATENTS.

Nickel Plating and for Polishing, Apparatus for. W. P. Thompson, London. From E. Paul, Aachen, Germany. Eng. Pat. 22,034, Oct. 19, 1898.

"The improved apparatus for electro-plating or coating with nickel small articles, such as needles, spikes, and so forth, characterised by the arrangement that the goods are placed in a receptacle open above and below, and divided into separate parts by cross partitions; said goods resting upon supports in the form of plates or strips preferably having pockets, said supports being in connection with the cathode; the goods being kept in motion by means of an agitator working to and fro, the anodes in the form of plates being adjustably arranged above and below the receptacle, and the whole apparatus with its contents immersed in a bath filled with the electrolyte substantially as described . . . . and illustrated."—J. C. R.

Alloys of Magnesium, Making. H. Bumb, Charlottenburg, Germany. Eng. Pat. 14,592, July 15, 1899. See Eng. Pat. 6297 of 1899 (this Journal, 1899, 843).

The claims here are for "alloys of magnesium with iron, copper, aluminium, cobalt, nickel, platinum, silver, lead, tin, zinc, antimony, chromium, manganese, tungsten, potassium, and sodium, effected by liquefying the metals by the application of heat substantially as set forth." The molten metal to be alloyed is made the cathode in a fused salt of magnesium. The cathode alloy "is kept in osmotic motion by the electric current until the whole of the molten metal is solidified, thereby preventing the combining together of those parts which have a special affinity for each other." These alloys are said to possess the following new technical properties: "They are more homogeneous and much harder and tougher than any of the magnesium alloys at present known, whilst all are malleable, and some make good electrical conductors. They are not brittle, and when exposed to the air do not oxidise."—J. C. R.

Cupric Sulphate and Copper, Electrolytic Process and Apparatus for the Production of Chemically Pure. E. Frenot, Paris. Eng. Pat. 15,438, July 27, 1899.

Apparatus, consisting principally of simple containing vats, is shown, for refining copper bars by electrolysis, and obtaining copper and copper sulphate. The copper anode is made to rotate, and any gold or silver it may contain is collected in the insoluble residue settling at the bottom of the tank.—J. C. R.

Aluminium, Reduction of, by Electrolysis. F. A. Gooch, Connecticut, U.S.A. Eng. Pat. 16,555, Aug. 15, 1899.

The bath is prepared by fusing together a suitable halogen compound of aluminium, such as the fluoride, and a suitable halogen compound of a metal more electro-positive with reference to sulphur than is aluminium, such as the fluoride of sodium, adding to the bath a suitable compound of sulphur, such as carbon bisulphide, together with alumina, and then passing through the fused mass a current of suitably low density.—G. H. R.

XII.—FATS, OILS, AND SOAP.

Wheat Oil, The Characteristics of. G. B. Frankforter and E. P. Harding. J. Amer. Chem. Soc. 1899, [9], 758—769.

The average quantity of oil found in the wheat germs in the authors' analyses was 11·6 per cent. When extracted with ether it had a golden-yellow colour and a characteristic odour. Its specific gravity was 0·9292 at 15° C., and 0·9374 at 0° C. At 15° C. it became milky, and at 0° C. became a cloudy semi-solid. When warmed at 100° C. its odour of freshly-ground wheat became very marked, and its colour changed to reddish-brown.

The oil was easily soluble in ether, petroleum spirit, chloroform, carbon-bisulphide, and acetone, the amounts of different solvents required to dissolve 1 grm. of the oil being:—Ether, 1 c.c.; chloroform, 1 c.c.; absolute alcohol, 30 c.c.; 90 per cent. alcohol, 250 c.c. When exposed to the air for two months it gained during the first 45 days 0·42 per cent. in weight, and then began to lose slightly. After 75 days the loss in weight was 0·42 per cent.

Its viscosity, compared with rape oil as unity, increased more rapidly from 0° C. to 20° C. than from 20° C. to 100° C. So that the maximum ratio between the two oils (2·57) was at 20° C. The ratios at other temperatures were: 0° C., 1·43; 10° C., 1·81; 30° C., 1·92; 60° C., 1·40; 80° C., 1·27; 100° C., 1·14.

The refractive index was determined by means of the Pulfrich refractometer. The crude oil, containing all the ether-soluble substances in the germ, gave the following readings:—20° C., 1·47878; 30° C., 1·47544; 40° C. 1·47181; whilst the corresponding values obtained with the oil after purification with alcohol were:—1·48325, 1·47936, and 1·47147 respectively. Wheat oil resembled linseed oil and maize oil in its absorption spectrum, showing absorption bands in different parts of the scale.

The saponification value varied from 187·40 to 190·27, the mean being 188·83. In these determinations the freshly extracted oil was used, as, after being left for some time, it yielded varying results. In this constant it resembled maize and pumpkin-seed oil, the mean saponification values of which were 188·21 and 190·7 respectively.

The iodine value was 115·64 on the average, the corresponding value of pumpkin-seed oil being 121, and of maize oil, 122·27.

The acid value varied in three determinations from 40·2 to 41·4.

The percentage of glycerin, which was determined by the Benedikt-Zsigmondy process, showed a variation in five determinations of from 7·2 to 7·53.

The amount of lecithin was calculated from the quantity of phosphorus found in the filtrate after the separation of the fatty acids from the soap solution. It amounted to (1) 2·03 and (2) 1·96 per cent. In making the calculation it was assumed that the lecithin was an oleyl rather than a stearyl ester, since little or no stearic acid was found in the oil. The formula used was $C_{42}H_{84}O_9NP$.

The authors found that the substance, which at first they regarded as phytosterin, was really its isomeride paracholesterin, since, after repeated crystallisation, it melted at 134°—135° C., and had an optical rotation of $[\alpha]_D = -26·9$ to $-28·88$. Its amount, determined by extraction of the dried soap with ether in a Soxhlet extractor, varied in five determinations from 2·37 to 2·6 per cent.

In this connection the authors give the following table of the melting points and optical rotation of the isomeric forms of cholesterin:—

—	Melting Point.	Optical Activity.	Authority.
	° C.	$[\alpha]_D$.	
Cholesterin	145—146	− 36·61	Hesse.
Phytosterin.....	132—133	− 34·20	Hesse.
Paracholesterin.	134—134·5	− 28·88	Reinke Rodewald.
Caulesterin.....	158—159	− 49·60	Reinke Rodewald.
Isocholesterin ..	138—138·5	+ 60·00	Schulze.

Among new methods tried for the extraction of the paracholesterin was one involving the use of the elaidin reaction. About 20 grms. of the oil were mixed with 10 grms. of mercury and 10 c.c. of strong nitric acid gradually added, the temperature being kept between 8° and 10° C. The whole mass was then treated with alcoholic potassium hyproxide in excess, evaporated to dryness on the water-bath, and extracted with ether. On evaporating the ether, the paracholesterin was left in a comparatively pure state, and obtained in a very pure condition by recrystallisation from alcohol. The amounts obtained in two determinations were 1·8 and 2·2 per cent. The objection to this method was that the drying required considerable time, and that any increase in the amount of nitric acid caused a decrease in the yield of paracholesterin, probably on account of the formation of a nitrolic acid.—C. A. M.

Maize Oil, Investigation of. H. Winfield. Pamphlet, New York, 1899, 1—49.

The work, of which a description is here given in pamphlet form, was undertaken with the object of examining conflicting statements as to the properties of maize oil, and obtaining a more complete record of its physical and chemical constants.

In the course of the research, experiments were also made on the effect of steam distillation in improving the oil for commercial purposes. The freshly expressed oil was subjected to steam distillation for about eight hours, the steam being employed at ordinary pressure, and sufficient heat being applied beneath the oil to prevent condensation. During the treatment there was considerable dissociation of lower esters in the oil, and a large amount of an insoluble fatty acid collected in the retort and the receiver. Subsequently the residual oil was separated from the water in the retort, washed repeatedly with boiling water, dried, and filtered.

It was found that the oil thus treated was considerably lighter in colour than the original oil, and that it was quite free from the odour due to the volatile oil. There was a small increase in the specific gravity and acetyl value, and a marked decrease in the percentage of free acid. The iodine value, bromine thermal value, and amount of oxygen absorbed were all less, and there was a considerable decrease in the total time required by the oil to dry. From these results the author concluded that the treatment had improved the oil, and rendered it more suitable for food, for lubricating purposes, and as a paint oil.

	I. Expressed Oil.	II. Expressed Oil, Ten Years' old.	III. Distillery Oil.	IV. Insoluble Fatty Acids.	V. Steamed Oil.
Specific gravity, 15·5° C.	0·9213	0·9213	0·9255	..	0·9234
" 100° C.	0·8711	0·8716	0·8756	0·8529	0·8731
Viscosity (water), 20° C.	10·27	9·79	..	..	10·70
" (rape oil), 20° C.	73·89	70·42	..	..	76·50
Refractive index, 15° C.	1·4766	1·4767	..	..	1·4766
" " 20° C.	..	1·4761	1·4765	..	..
Melting point	..	..	..	22·4° C.	..
Ash, per cent.	..	0·065	0·0655	..	..
Acid value	2·25	3·70	20·65	..	1·70
Iodine value	118·62	119·74	113·27	120·98	112·76
Saponification equivalent	291·22	291·21	292·55	281·72	296·02
Ether value	190·39	188·95	171·13	..	187·83
Hehner value	92·23	92·79	88·21	..	..
Reichert value	4·2	4·3	9·9	..	..
Acetyl value	11·49	11·12	..	..	12·15
Glycerin, per cent.	10·35	10·545	..	..	..
Unsaponifiable matter, per cent.	1·45	1·39	..	..	..
Colour tests:—					
Heidenreich, H_2SO_4	Mahogany-red to dark red-brown		Mahogany to claret.	..	..
Carbon bisulphide, H_2SO_4	Golden-brown: violet after 24 hours		Claret: violet in 24 hours.	..	..
Hauchecorne, HNO_3	Orange-yellow		Mahogany	..	..
Becchi, $AgNO_3$	Dark brown		Dark brown	..	Dark brown.
Brullé, $AgNO_3$	Black		Black	..	Black.
Wellman, phos. mol. acid	Dark green, changing to bright blue.		Light green and blue.	..	..
Renard, $SnBr_4$	Brown-violet		Brown-violet	..	..
Hirschsohn, $AuCl_3$	Pale green		Yellow-brown	..	..
Elaidin test	Orange deposit; red liquid		Orange solid; dark red liquid.	..	..
Maumené, rise	74° C.	75° C.	..	..	77° C.
" specific temperature	176·2	178·6	..	..	183·3
Bromine thermal value (factor, 5·5)	21·8° C.	21·9° C.	..	21·6° C.	20·4° C
Calculated iodine value	119·90	120·45	..	118·8	112·2
Valenta's test	80° C.	74° C.	65° C.	..	60° C.
Livache test, per cent. gain	5·19 in 10 days	5·97 in 7 days	..	..	3·50 in 4 days.

The table given above summarises the analytical results obtained with different samples of maize oil. The expressed oil (No. 1) was freshly obtained by hydraulic pressure, and is representative of the ordinary commercial product. No. 2 was a specimen of expressed oil 10 years old, which had been preserved from the action of light and air. No. 3 was a sample obtained from a distillery mash, and was about 15 years old. It had a golden-brown colour, and was practically a different oil from that obtained by expression. The insoluble acids (No. 4) were prepared from No. 1, as was also the steamed maize oil (No. 5).

(See also this Journal, 1892, 504; 1893, 607, 848; 1894, 257; 1895, 501; and 1899, 152.)—C. A. M.

Cotton-Seed Oil, Becchi Reaction for the Examination of. P. Soltsien. Zeits. öffentl. Chem. 5, 306—308; Chem. Centr. 1899, 2, [10], 539.

The presence of sulphur in cotton-seed oil has been considered doubtful, but the author found that oils extracted from the seeds by means of petroleum spirit contained sulphur, whilst, on the contrary, those obtained by cold-pressing only gave a doubtful sulphur reaction. With rape oil also, the presence of sulphur depends upon the method of extraction.

The Becchi reaction is due not only to reduction of silver, but also to the formation of silver sulphide, and it is known that the reaction is strengthened by the addition of rape oil. The author found, however, that rape oil which had previously been desulphurised by heating to 150° C., no longer gave the Becchi reaction. As cotton-seed oil which has been heated to 200° C. also no longer gives the reaction, here, likewise, desulphurisation appears to have been effected.

—A. S.

Saponification, The Theory of. J. Lewkowitsch. Proc. Chem. Soc. 15, [213], 190.

The author showed that the view of the theory of saponification, according to which the hydrolysis of triglycerides is considered a tetramolecular reaction, must be abandoned in favour of the theory propounded by Geitel, who regards the reaction as bimolecular. If this be so, diglycerides and monoglycerides should occur in partially hydrolysed fats. The author has demonstrated their presence by acetylating the intermediate products, freed from glycerin, and proving that the acetylated products exhibit considerable acetyl values, which rise and fall with the progress of saponification. Additional proof was obtained by determining the amounts of the insoluble fatty acids of the acetylated products, and also their saponification values. The curves illustrating these two series of values correspond to the acetyl curves in a very satisfactory manner. (See also this Journal, 1898, 1107.)

Oleic and Elaidic Acids, Note on the Action of Dilute Nitric Acid upon. F. G. Edmed. Proc. Chem. Soc. 15, [213], 190.

In the course of some experiments on the oxidising action of nitric acid upon oleic acid, the author found that, by using nitric acid of sp. gr. 1·2—1·3, the sole action was an isomeric change from oleic to elaidic acid. If the density of the acid did not exceed 1·25 and the action took place in the cold, the yield of elaidic acid was quantitative. The elaidic acid thus prepared melted at 45° C. Increase in the strength of the nitric acid and rise of temperature diminished the yield. The rapidity of the change was dependent on the purity of the oleic acid. The dilute nitric acid used in the experiments was carefully freed by prolonged boiling from nitrous acid, which is known to bring about a similar change.

Nitric acid of the strengths indicated above has no action in the cold upon elaidic acid itself. Hot concentrated nitric acid decomposes it only upon prolonged boiling.

Sesamé Oil, Detection of. A. Bomer. Zeits. f. Untersuch. Nahr. und Genussmittel, 1899, **2**, [9], 705.

See under XXIII., *page* 1054.

Sesamé Oil, New Colour Reactions of. J. Bellier. Ann. Chim. anal. appl. **4**, 217; Chem. Centr. 1899, **2**, [8], 453.

See under XXIII., *page* 1054.

Walnut-Oil Cake: Its Composition, Application and Value as Food Material. B. Fallot. J. d'Agric. prat. 1898, 628; Chem. Centr. 1899, [13], 629.

See under XVIII. A., *page* 1045.

Sewage Clarification at Frankfort [Recovery of Fatty Matters], Investigation of the Sludge obtained in the. Bechhold. Zeits. angew. Chem. 1899, [36], 849.

See under XVIII. B., *page* 1046.

Iodine Value, Notes on the Determination of. J. Lewkowitsch. Analyst, 1899, **24**, [10], 257.

See under XXIII., *page* 1057.

Soaps, The "Scouring Power" Factor in the Valuation of. F. W. Richardson and A. Jaffe.

See under Yorkshire Section, *page* 998.

PATENTS.

Oleaginous Seeds, Apparatus for Treating. A. Euston, St. Louis, Missouri, U.S.A. Eng. Pat. 17,012, Aug. 22, 1898.

According to this invention the seeds are enclosed from the time they are crushed until placed in the final press for extracting the oil, the process being entirely mechanical. The seeds, after being crushed in mills which work substantially in the same manner as those described in Eng. Pat. 28,206 (this Journal, 1898, 254), are discharged into a trough, whence they are carried by a screw-conveyor into a drying apparatus like that described in Eng. Pat. 26,849, Dec. 20, 1898 (this Journal, 1899, 378). From this they pass into a closed trough surrounded by a steam-jacket and containing a screw-conveyor, the spiral of which is broken, forming a series of interrupted angled flights. By means of this the seeds are continually turned, whilst being constantly forced upwards into an open space above, where they are subjected to the action of steam so as to acquire a uniform degree of moisture. After this treatment they are discharged into another trough, thence conveyed to tempering kettles, and finally moulded and pressed.—C. A. M.

Soap Compound [Pepsin]. D. Gray, jun., Inverness. Eng. Pat. 23,806, Nov. 11, 1898.

Claim is made for a soap containing active pepsin, which is said to act upon dead epidermal tissue and be beneficial in skin diseases. It is manufactured preferably by adding from 8 to 10 per cent. of a glycerin preparation of pepsin ("glycerole of pepsin") and 2 to 3 per cent. of an antiseptic, such as borax, to a superfatted soap in a liquid state, care being taken to keep the temperature of the mixture below 100° F. Tallow is preferred for the basis of the soap and colouring matters are (preferably) not added.—C. A. M.

Rosin Soap, Manufacture or Production of. C. Dreher, Freiburg, Baden. Eng. Pat. 24,375, Nov. 18, 1898.

Claim is made for the manufacture of a soap containing a high percentage of rosin by dissolving the latter in phenol or its homologues, and partially saponifying with alkali, of which a much smaller quantity is required than in the usual processes. Or a carbolic solution of rosin may be added to a rosin soap manufactured in the usual way. It is claimed that soaps thus prepared are especially suitable for sizing paper pulp, since the phenols do not discolour the paper, and are incombustible, whilst they are completely volatilised in the hot drying rolls, so that the finished product is inodorous.—C. A. M.

Soap or Cleansing Material, Improved. D. F. Malézieux, Rainey, near Paris. Eng. Pat. 27,234, Dec. 24, 1898.

This consists of a mixture of a soap paste with a suitable proportion of wood shavings, sawdust, or other fibrous material.—C. A. M.

Oil from Seeds, Nuts, Beans, and the like, Process and Apparatus for Extracting. G. Mitchell, Westminster, Middlesex. Eng. Pat. 21,740, Nov. 23, 1898.

The process claimed is one "for extracting oil from seeds, nuts, beans, &c., which consists in first submitting these in the form of meal to the action of a suitable solvent" (preferably carbon bisulphide); "then precipitating any portion of solid matter suspended in the combined solvent and oil, and returning such precipitate to the body of meal and solvent within the treatment chamber, thereby allowing the combined solvent and oil to be drawn off from the process, free from solid matter."

"Briefly summarised, the complete process allows of the introduction of two substances: (1) the material to be treated, (2) the solvent; and has two issues, (1) the oil mixed with the solvent, and (2) the residual dry meal." —C. A. M.

Oil Extracting, from Oleaginous Seeds; Hydraulic Presses particularly adapted for. A. Euston, St. Louis, Missouri, U.S.A. Eng. Pat. 17,013, Aug. 22, 1899.

The object of this invention is to simplify the mechanism supporting the plates in the press. Supports are provided co-operating with each individual plate so that it may be independently released, or held up at will, or operated in unison with the remainder of the plates. In the plates preferred, hair cloths or matting between the cake and the metal are dispensed with, the two sides and front edge of the plate being provided with ribs, whilst the rear side is left open for the oil to escape. Various combinations of different parts of the apparatus are embodied in a series of claims. —C. A. M.

Oil, Extracting, from Oleaginous Seeds; Hydraulic Presses particularly adapted for. A. Euston, St. Louis, Missouri, U.S.A. Eng. Pat. 17,014, Aug. 22, 1899.

The improvements claimed consist essentially in a number of movable projections mounted on the plates of the press and co-operating with supports so that the plates can be maintained in an elevated position, or each individual plate lowered at will. The combination and arrangement of the several parts is embodied in a series of claims. It is stated that the advantages of this apparatus are that the usual clearance between the plates is dispensed with, so that the capacity of the press is increased without increasing its size; and that each plate is under the control of the operator, and does not follow the ram in its descent.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

Two Hydrated Cobalt Oxides, Green- and Buff-coloured. W. N. Hartley. Proc. Chem. Soc. **15**, [213], 202.

The preparation and analysis of two hydrated cobalt oxides is described. The green compound was formed when a cold solution of cobalt chloride was precipitated by an equivalent quantity of barium hydroxide, both solutions having been boiled, and a Torricellian vacuum being maintained in the precipitating vessels. Its formula is $Co_3O_4,6H_2O$. The buff-coloured compound resulted when the precipitation was carried out in like manner, but with excess of barium hydroxide. Its composition is $Co_5O_9,11H_2O$.

The action of acetic acid on the green hydrate separates a brown oxide already known as Co_3O_4. There was a similar action and the separation of black oxide from the buff-coloured hydrate. This points to the following formulæ: Green hydrate, $Co_2O_3,Co(OH)_2 5H_2O$. Buff hydrate, $Co_2O_3,6Co(OH)_2,5H_2O$. These are distinct compounds, and not merely mixtures.

PATENTS.

Lead Oxide, Production of, and Means or Apparatus employed therein. Matthews' Lancashire, Cheshire, and North Wales District White Lead Company, Ltd., S. Pope, and G. V. Barton, Runcorn. Eng. Pat. 17,178, Aug. 9, 1898.

Lead is kept in a fused state in a closed pot, a blast of air and steam is directed upon the surface, and the film of oxide is carried by the blast through an outlet into a collecting chamber.—S. K.

Oxide of Zinc and Carbonate of Zinc, A Process for the Production of, from Ores or other Materials containing Zinc. G. Rigg, Swansea. Eng. Pat. 22,366, Oct. 25, 1898.

The zinc must be in the form of oxide, or carbonate, or metal in order to be available for this process, which consists in leaching the material with a solution of ammonium carbonate or a mixture of this with ammonium hydrate. The zinc-dissolving capacity of the solution varies with the amount of carbonic acid present. The zinc in solution is precipitated by means of carbonic acid gas, and the precipitate, a mixture of zinc hydrate and carbonate, is converted into oxide by heat.—S. K.

Distempering or Painting, Compositions for. A. Nevin and T. Bulfield, Liverpool. Eng. Pat. 24,932, Nov. 25, 1898.

Whiting is steeped in benzoline and mixed with gold size and copal varnish, with or without boiled linseed oil, and, if desired, with a colour. This composition is claimed to be particularly suitable for first coating of greasy paint work. —S. K.

Compositions or Paints for Preserving Ships' Bottoms and other Structures, and for Preventing the Adhesion of Barnacles and other Marine Growths. H. E. Julyan, London. Eng. Pat. 9171, May 2, 1899.

For iron or steel, *Cocculus indicus* is added to a mixture containing red oxide of mercury, iron oxide, arsenic, creosote, lime, shellac, and methylated spirit. For wood, *Cocculus indicus* is mixed with copper arseniate, mercuric oxide, arsenic, creosote, lime, shellac, and methylated spirit. —S. K.

Antifouling Coating for the Wooden Surfaces of Submerged Structures, Improved Method and Means for the Application of. R. W. James, London. From G. D. Coleman, Boston, U.S.A. Eng. Pat. 14,068, July 7, 1899.

Indentations are cut in the wood, and a coating of comminuted copper in a paste soluble in water is applied. The copper is then driven into the surface of the wood by a hammer. The interstices between the small particles of copper may be filled up with any antifouling paint, although the metallic copper, by getting oxidised, and then forming a copper salt, would suffice to prevent the accumulation of marine growths.—S. K.

(*B.*)—RESINS, VARNISHES.

Exudation Resins. M. Bamberger and A. Landsiedl. Monatsh. für Chem. 1899, **20**, [7], 647—659.

The authors have examined further and purified the *Lariciresinol* described by them in a former paper (this Journal, 1897, 1024). From solution in absolute alcohol it separates, on dilution by petroleum spirit or water, in brilliant white crystals, which melt at 169° C., and give on analysis figures agreeing closely with the formula $C_{19}H_{22}O_6$. On treatment with acetyl chloride, a tetra-acetyl derivative is obtained, which melts at 160° C. (and which, on saponification with alcoholic potash and treatment with acid, yields an isomer of the original lariciresinol, melting at 97° C.); while acetic anhydride, acting on the potassium compound of lariciresinol, gives a triacetyl derivative, melting at 92° C. By Zeisel's method, lariciresinol is shown to contain two methoxy-groups, so that its formula becomes $C_{17}H_{12}(OCH_3)_2(OH)_4$. The authors have also prepared the dimethyl- and diethyl-ethers of lariciresinol.—J. T. D.

Asafœtida, Composition of Commercial. R. W. Moore.

See under New York Section, *page* 987.

PATENT.

Aluminium and other Metals, An Improved Preparation and Process for Varnishing of. O. P. Nauhardt, Paris. Eng. Pat. 14,686, July 17, 1899. (Under Internat. Conv.)

One hundred parts of gum-lac are dissolved in 300 parts, by weight, of ammonia; the metal, before being coated with this varnish, has to be carefully cleaned by means of potash, dried, and, when varnished, to be stoved at 300° C.—S. K.

(*C.*)—INDIA-RUBBER, &c.

Piralahy Rubber of Madagascar. H. Jumelle. Comptes Rend. 1899, **129**, [6], 349—381.

The author gives an account of a rubber plant known to the natives as *Piralahy* or *Vahealahy*. This is a climbing plant which is found in all the forests of Bouèni, at Majunga, Andriba, and in the valleys of the Ikopa, Betsiboka, and Menavava, and appears to be a new species of *Landolphia*. It is quite distinct from *L. madagascariensis*, but somewhat resembles *L. crassipes*. It has been given the name, *L. Perieri*.

The rubber is obtained by the natives, by cutting the stem into pieces, allowing the latex to drain off, and then coagulating it by the addition of lemon juice or crushed tamarind fruit. In the dry season the plant yields very little latex, and this coagulates spontaneously, whilst in the rainy season the milk is much thinner, but gives only a small quantity of rubber—about 60 grms. per litre. The rubber is stated to be of good quality, and contains only 5·5 per cent. of resin.

The latex obtained from the plant during the rainy season was examined; it was prevented from coagulating by the addition of ammonia. The latex, after evaporating off the ammonia, had a specific gravity of 0·996, which is lower than that of most latices containing caoutchouc, but is explained by the low density of the contained caoutchouc and the small proportion of other substances in solution. The separated rubber had the sp. gr. 0·910 (Para rubber, sp. gr. 0·920), and 100 grms. of the solid matter obtained by evaporation of the latex contained only 8—10 grms. of substances other than caoutchouc. The latex contained neither glucose nor starch. The globules of caoutchouc in the latex were small, measuring from 0·0020 to 0·0022 mm. Those in the latex of *Hevea braziliensis* (yielding Para rubber) have a mean size of 0·0035 mm.

The latex from Piralahy also differs from most others in that coagulation is not readily brought about by boiling or by the addition of alcohol. When the latex is boiled, coagulation only occurs in proportion to the amount of evaporation, and the rubber is not entirely separated until the evaporation is complete; whilst to effect coagulation with alcohol, it is necessary to add to the latex 4—5 times its volume of absolute alcohol. The coagulation can, however, readily be effected by the addition of a number of reagents, many of which have no action on other latices. These reagents include sulphuric, hydrochloric, acetic, and citric acids, caustic potash, alum, the sulphates of magnesium and sodium, chloride of sodium, the nitrate and sulphate of calcium, and the oxalates of potassium and ammonium.—A. S.

Caoutchouc, Action of Gases on. D'Arsonval. Comptes Rend. **128**, [26], 1545.

Gaseous carbon dioxide is caused to act on fragments of india-rubber tubing under pressures of 1 to 50 atmos. Under these conditions they are found to increase in volume considerably, and absorb large quantities of the gas. When exposed to the air, the rubber returns, in about an hour, to its original state. Carbon dioxide passes very rapidly through an ordinary pneumatic tyre inflated with it. When the tyre is inflated with air it slowly becomes deflated. This deflation ceases after a time, however, if the pressure be maintained constant by pumping in fresh air. The tyre is then found to contain almost pure nitrogen, owing to the fact that oxygen passes through india-rubber much more readily than nitrogen.

Vulcanising India-Rubber Gummi-Zeit. **14**, 17 and 33.

An india-rubber article may be considered as "vulcanised," when it possesses the elasticity and strength required by the nature of its use. These properties are imparted to the rubber by the sulphur, but it is impossible to say how much sulphur is required to attain this end, as rubber may be vulcanised as well with 1 per cent. as with 25 per cent. of sulphur. Nor is the vulcanisation of india-rubber accompanied by any rise of temperature, no matter how large a proportion of sulphur be employed and how large a bulk of india-rubber be treated at one time. It is found invariably necessary to maintain throughout the process the required degree of heat by artificial means. On analysing vulcanised india-rubber, a small quantity of uncombined or free sulphur is always observed, due to coarse particles in the flowers of sulphur used in vulcanising. As soon as sulphur free from coarse particles is used, and thoroughly mixed with the rubber, products are obtained which contain no free sulphur, however large a proportion of sulphur be employed. From this it follows that the vulcanisation of india-rubber is not due to any direct chemical action, but that the sulphur, in the molten state, is merely absorbed by the cells of the rubber, forming a kind of alloy with it. This view, the author contends, is confirmed by the facts observed in the "regeneration" or "recovery" of vulcanised india-rubber, in which no sulphur at all is abstracted from it. The separation of the sulphur of vulcanisation from the india-rubber can be effected by means of solvents, such as benzene, in which the latter is more soluble than the former; and by repeating this operation a number of times, complete devulcanisation can be obtained. This devulcanised rubber differs in many respects from virgin rubber.

Vulcanisation with chloride of sulphur, like that with sulphur, can only take place in india-rubber sufficiently softened to absorb sulphur. In this case the softening is produced by solvents, such as carbon bisulphide, which at the same time are capable of dissolving chloride of sulphur. The vulcanisation by such solutions also consists simply in an absorption of sulphur from them by the india-rubber, and it is found that while the percentage of sulphur in such solutions gradually decreases, that of chlorine correspondingly increases. Further confirmation of this view, according to the author, is to be found in the fact that india-rubber, on prolonged immersion in this vulcanising solution, forms products containing from 5 to 6 per cent. of sulphur, but only from 1 to 2 per cent. of chlorine. It is further observed that the chlorine of the chloride of sulphur appears in combination with sulphur as a moist exudation on the surface of the vulcanised article during the drying, only sulphur being retained by the india-rubber. Chloride of sulphur appears to separate sulphur spontaneously, and this is the sulphur which effects the vulcanisation. Solutions of sulphur in carbon bisulphide cannot be used for vulcanisation because they deposit their sulphur in the crystalline form. The process of vulcanisation by immersion in a bath of molten sulphur further shows that, however performed, vulcanisation simply consists in the impregnation of india-rubber with sulphur.—C. O. W.

India-Rubber- and other similar Waste. Gummi-Zeit. **14**, [1], 5.

The recovery of india-rubber waste is assuming increased importance in consequence of the considerable rise in the price of raw rubber. The rubber waste or scraps produced in the manufacture can of course be utilised again without any special preparation; the bulk, however, of what is known as rubber waste consists of old india-rubber articles. These are first ground, and, if they contain textile materials, treated with acids for their removal. Floating waste, consisting of articles manufactured chiefly from pure rubber mixtures, is of course more valuable than non-floating waste, which generally contains varying quantities of substitutes, mineral matters, and pigments.

Ebonite waste is obtained in the form of cuttings, turnings, and dust, which, when finely ground, form a suitable admixture to fresh mixings. They can also be used for the production of lacquers and varnishes.

Gutta-percha waste generally re-enters into the manufacture without any special treatment. Gutta-percha which has become hard and brittle by exposure cannot, so far, be re-used.

Asbestos waste is obtained in large quantities in the purification of crude asbestos. This short, fibrous material may be used for the manufacture of cheap asbestos board. By mixing it with slaked lime, plaster of Paris, or cement, an excellent plastering material for walls is obtained, producing smooth, durable, and fire-proof surfaces.

—C. O. W.

Gutta-Percha from a Plant which may be cultivated in Temperate Climates. Dybowski and Fron. Comptes Rend. **129**, [15], 558–560.

The plant in question was described by Oliver and Weiss in the Journal of the Linnæan Society in 1892, and named by them ***Eucomia ulmoides***, from the similarity of its leaf to that of the elm. The authors have examined a specimen of this plant in the Paris Colonial Garden. The fresh leaves contain 70 per cent. of water, and, after drying, yield about 2¼ per cent. of their weight (0·7 per cent. of the fresh leaves) to toluene. The fruit (200 weighing from 13 to 15 grms.), undried, yielded about 27 per cent. of its weight. The product is brown, showing a metallic lustre; it softens in hot water, and can then be drawn out into films like goldbeaters' skin, or made to take the impress of a medal, and, on cooling, it again hardens. It is pronounced by a technical authority to be gutta-percha of good quality.

The plant from which the authors' samples were obtained came from the north of China, and has borne Parisian winters, so that it may apparently be grown in temperate climates. It does not readily germinate from seed, but can be easily propagated by cuttings.—J. T. D.

Albane from Gutta-Percha. Gummi-Zeit. **14**, 35.

Albane is one of the constituents of gutta-percha, from which it is obtained, together with fluavil, by extraction with boiling alcohol; the yield being from 14 to 15 per cent. of the two together. It forms microscopically small feathery crystals, soluble in ether, petroleum spirit, chloroform, benzene, carbon bisulphide, and boiling alcohol. 100 parts of alcohol dissolve 5·1 parts in the cold and 5·4 parts at boiling point. The melting point is 160° C. Its chemical formula, according to Payen and Oudemanns, is $C_{10}H_{16}O$, or $C_{20}H_{32}O_2$ with 78·92 per cent. of carbon, 10·40 per cent. of hydrogen, and 10·68 per cent. of oxygen. Oesterle attributed to it the formula $C_{40}H_{64}O_2$, but the later investigation of Obach again confirms Oudemann's original formula, $C_{10}H_{16}O$, The presence of albane is not detrimental to the quality of gutta-percha.—C. O. W.

"Velvril" Material: A New Substitute for India-Rubber and Gutta-Percha. F. W. Reid.

See under London Section, *page* 972.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Leather, The Manufacture of. H. R. Procter. J. Soc. of Arts. Cantor Lecture I. 2445, **47**, 827.

The epidermis, including the hair, horns, and the like, is formed of simple animal cells, deriving their nourishment from the lymph of the corium, and is of no technical value. It is chemically closely allied to coagulated egg albumin, and is only soluble in water at a high temperature, and under pressure, to a viscid non-gelatinising solution. It is almost equally insoluble in acids, but comparatively readily soluble in alkaline solutions. Alkaline sulphides dissolve and break up even the harder tissues of the epidermis rapidly, and are thus becoming of great importance for unhairing the hides, as they affect the corium but slightly.

The corium consists of a white fibrous tissue, almost identical with gelatin, and probably only differing from it in its degree of hydration, interwoven with which are yellow "elastic fibres," forming a sort of elastic skeleton to the skin. The true skin harbours a quantity of fat, not in free globules, but enclosed in cells, by which it is secreted, which explains the impossibility of freeing the hides from grease without first breaking down the cell walls with milk of lime or bacterial ferments. The white fibres are swollen even by cold water, and readily dissolve at a moderate temperature, forming a solution viscid while hot, which gelatinises on cooling. The corium is thus one of the most important sources of glue and gelatin, the other being the gelatinous tissue of bones, freed from their calcium phosphate by the action of acids. The glue boiler, after purifying the skin cuttings or bones from injurious mineral and animal matters, digests them cautiously to dissolve the gelatin; the clear solution is then cooled in moulds, cut in slices and dried. Glue differs from gelatin only in its less careful purification and handling during manufacture.

Dried skin swells in cold water in the same way as gelatin, but is not nearly so easily liquefied by heat; the white fibre is therefore not absolutely identical with gelatin.

The white fibres of skin absorb a much larger volume of a very dilute acid than of pure water, but very little skin-substance is dissolved, moderately strong acids or alkalis apparently dissolve the fibre without decomposition, while very strong acids and alkalis decompose it forming peptones, amido-acids, ammonia, and probably other products.

Preparatory to being tanned, the skins, where they come direct from the butchers, are cleansed from the blood and dirt by soaking for a few hours in a pit, and then washing for a short time in a "wash-wheel" or "tumbler," which is a large perforated rotating drum, into which water is introduced through the axle. Raw material, preserved by salting, must be soaked about four days, owing to the dehydrating effect of the salt, before it is properly swelled, and this should be supplemented by 10 to 20 minutes in the "wash-wheel." Dried goods are much more difficult to deal with. Eitner has shown that skin dried at a low temperature softened rapidly and completely in water, while it was impossible to soften skins dried at 60° C. sufficiently to tan, even with the aid of mechanical kneading. The old process for softening dried goods, and the one still in use in India, is to soak them in pits in which the water being never changed, is charged with putrefactive bacteria, which greatly facilitates softening, although at the cost of a considerable loss of hide substance. The present mode of treatment in England is to place each parcel of goods in fresh water, which is not changed till softening is complete. Kips require about a week, while so-called "arsenic-cured" goods take considerably longer. The soak-water naturally becomes putrid, and improvements are being sought after, both in the interests of the tanner and the public, either to chemically quicken the softening, or antiseptically to prevent putrefaction, or both. Caustic soda, 1 lb. in 100 galls. of water perhaps aids the softening most effectually, and actually, as Eitner has shown, dissolves less substance in the time required, and so yields a better leather. Sulphide of sodium is not so effective, and borax at the strength required (1 per cent.) would be too expensive. Another promising method is the use of sulphurous acid, 1 part to 1,000, which swells the hides in 42 hours, and is also a powerful antiseptic. Carbolic acid and other aromatic disinfectants are not satisfactory in conjunction with alkalis, and alone have no softening effect. Where only water is used for the soaking, it is usual after the goods have been soaked a few days, to assist the softening mechanically by a hammering process in a machine called in England a "fulling mill" or "fuller stocks," while in America a modified form called a "hide mill" is preferred.

The lighter skins, those of goat and calf, are worked over with a blunt unhairing knife on the flesh side, and before stocks were introduced, the same method had to suffice for heavier goods also.—A. M. F.

Raw Animal Hair by Vapours, Disinfection of. G. Frank. Zeits. öffentl. Chem. **5**, 340—346; Chem. Centr. 1899, **2**, [11], 564.

The author states that the best gaseous disinfectant is steam at 100° C. or a higher temperature, but the use of this agent causes injury in the case of certain materials, as hides, skins, leather, and raw animal hair. These products, nevertheless, need to be completely disinfected because of the risk of certain cattle diseases, such as anthrax. The instructions issued by the German Imperial Chancellor for the disinfection of pigs bristles consist in (1) The action of a current of steam under pressure for half an hour; (2) Boiling for quarter of an hour in 2 per cent. permanganate solution followed by bleaching with a 3—4 per cent. SO_2 solution; (3) Boiling for at least 2 hours in water. All these methods however injure the raw hair.

The author has examined the disinfectant action of the vapours given off by (1) Concentrated acetic acid; (2) Crude wood-acid; (3) The "light oil" obtained as the first distillation product in the carbonisation of wood; (4) First runnings from wood distillation and (5) A mixture of "first runnings" of wood naphtha and formaldehyde. He concludes, from the results of his experiments, that for the thorough disinfection of animal hair, three agents are suitable, crude wood-acid, first runnings; also a mixture of formaldehyde and wood naphtha, first runnings, the last-named being the most worthy of consideration.—A. S.

Tanneries, Anthrax in. Chem. and Druggist, Oct. 28, 712.

In a report from the Bact. Dept. of the State of Pennsylvania it is stated that 12 men and 60 head of cattle died last year from anthrax—through being employed upon tannery-works in the case of the men, and pasturing on land adjacent to tanneries in the case of cattle. The men manipulating the wet skins are much less liable to anthrax-infection than those engaged in handling the dry hides, and the explanation appears to consist in the softness of the one and dryness of the other; the rough edges of partly cured leather finding out abrasions more readily. The most dangerous material is dried but otherwise untreated hide. Numerous experiments extending over the whole time occupied in making skins into leather have been conducted by Dr. Ravenel, with the result that silk impregnated with anthrax material and passed through all the stages of tanning was at no time incapable of reproducing the specific bacillus. The solutions used in the State of Pennsylvania contain approximately from 1 to 7 per cent. of tannin. But recently an inquest was held on the body of an operative at Liverpool who had died of anthrax contracted in the same way.

Leather, Fraudulent Weighting of, and its Detection. R. Burckhardt. Der Ledermarkt, Sept., 1899. (Through Leather Tr. Rev. **32**, [708], 989.)

Fraudulent weighting of leather is perpetrated, when, either in the process of tanning or currying, certain substances are added which are not used in order to improve the quality of the manufactured article, but merely to abnormally increase its weight. Among such substances should be mentioned water, tannins, and non-tanning matters, fat, glucose, magnesium sulphate, barium chloride and "barytes." Such adulterants are chiefly found in leather sold by weight, such as sole leather, and in England, the heavier dressing leather. As many of these always exist in certain proportions in leather, it is difficult to ascertain when excess is present. All leather must contain a certain quantity of water, but excess, which may be added to increase the weight, can sometimes be detected by the eye or the touch of the practical man. It is not generally known amongst the latter what is the quantity of water which leather may legitimately contain. The following table, which von Schroeder published, will prove interesting.

As regards tanning and non-tanning matters, their presence in excess can only really be determined by the loss of weight which occurs when the leather is soaked in water, or by determination of its specific gravity. When

——	Average.	Minimum.	Maximum.
	Per Cent.	Per Cent.	Per Cent.
Sole leather (sweated)	17·76	15·25	20·87
" (quebracho tanned).	16·60	15·00	18·22
" (limed)	16·76	14·22	19·86
Strap leather	18·02	15·88	20·38
Harness leather	17·96	15·75	20·76
Horse leather...............	13·53	11·88	15·63
Calf skin (oak tanned)......	15·61	13·71	17·98
Kip.......	15·92	13·69	18·97
Sheep-skin (tanned)	16·72	14·35	20·27

the leather is immersed in cold or lukewarm water, the normal loss of weight varies from 4 to 6 per cent. With an adulterated or heavily tanned article, however, it may amount to from 10 to 22 per cent. The normal percentage of grease for strap leather is from 15 to 25 per cent. An excess of grease can easily be detected by the eye and touch of a practical currier, except in the case where rosin is added to the grease.

As regards glucose, a certain quantity is always present. Any excess may be regarded as added artificially. Both sulphate of magnesia and chloride of barium are easily soluble in water, and therefore the detection of their presence is easily established. Barytes is an adulterant which is often met with. It is formed in the tissues of the leather by treating the latter first with a solution of chloride of barium, and subsequently with sulphate of soda. Being insoluble it must be estimated in the ash, which under ordinary circumstances does not exceed at most 3 per cent., but if barium salts be present is frequently higher. A simple method of testing the quality of leather with regard to illicit weight is the determination of its specific gravity. The normal specific gravity of a leather is about 0·933. If it exceed 1·1, it should be ascertained to what constituents in the leather the unusual weight is due.—J. G. P.

One-Bath Chrome Tannage. Shoe and Leather Reporter, Sept. 1899.

A method of making a one-bath chrome liquor has been recently patented in the United States by J. W. Smith, under date March 18. The inventor claims that the following method produces a superior waterproof leather. The solution is made as follows :—

Twelve lb. of chromic acid are dissolved in about six galls. of hydrochloric acid of specific gravity, 1·146 ; 50 lb. of crystallised chrome alum are dissolved separately in about 20 galls. of water ; in a third vessel, 75 lb. of crystallised carbonate of soda are dissolved in 10 galls. of water. The soda solution is now slowly and carefully added to the chrome alum solution with constant stirring. When the compound assumes a cloudy appearance, and a fine sparkling silvery mist is seen rising from the top, the addition of the soda solution must be discontinued, and sufficient water must be added to make the whole amount to 44 galls. This combined solution is now added to the solution of chromic acid, and allowed to settle for 24 hours. A 1½ per cent. liquor of this mixture is now made, and the bath kept at a temperature of 80° F., which must be maintained throughout the tanning process, the strength of the bath being gradually increased during the treatment of the hides by adding more of the strong solution at intervals in about half gallon quantities, until the strength of the bath reaches from 4 to 5 per cent. When the thickest parts of the hide show a deep greenish-blue appearance they are sufficiently tanned, and are then removed from the bath and washed in water containing an ounce of borax to every 20 galls. With such a liquor, sheep skins usually require about an hour, goat skins 1½ hours, calf from 2—4 hours, and the heavier hides 10 hours. Skins tanned according to this specification are said to be specially adapted where waterproof stock is required.—J. G. P.

East India Kips. Home Tanning and Currying. Leather Trades' Rev., **32,** 921 and 993.

In addition to the millions of foreign tanned kips annually imported from Madras, Bombay, and other Indian ports, an enormous domestic business has been done for some years past in tanning and dressing the raw pelt.

The demand for leather lining in boots and for cheap military foot wear, together with the fact that kip shoulders are very suitable for enamelling and japanning, has made trade in these goods very important. The following is a general concise description of the processes through which the skins are passed. They are first put into clean water, which generally contains a quantity of salt dissolved in it. Formerly it used to be the custom to use "putrid soaks," but chiefly on account of the River Pollution Acts, the old soak method has been superseded by the salt and water method.

After the goods have been softened to the consistency of rubber, they are stocked, and while in the stocks a jet of water is constantly played upon the kips to prevent the grain cracking. They are now washed in a tumbler through which plenty of clean water is passing, and when sufficiently soft are ready for the limes. Kips require about 21 days, and the limes must be in good mellow condition; sodium sulphide is sometimes used in conjunction with the lime. They are then unhaired in the stocks, but are previously sprinkled with a little cod oil, which makes the hair move more easily, and forming a sort of soap or emulsion with the lime, scours the kips as well.

In fleshing kips, which are of a tighter nature than English hides, the "brushing edge" is kept sharp, and is more used than the "cutting edge," as the flesh and the "rhind" can be forced off if the kips are in a properly limed condition, the cutting edge being only used on the butt end, neck, and shanks. This "brushing" has also an advantage, as it tends to break or soften hard kips. After the goods are fleshed they are well washed, either through a tumbler or in a paddle, the latter for preference, as the goods get an even turn in the water. A small quantity of hydrochloric acid or ammonium chloride may be added to the paddle as a means of ridding the pelt of superfluous lime. 10 to 15 minutes are quite long enough in such a solution.—J. G. P.

Kid Glove Manufacture, Luxemburg. J. Soc. Arts, 1899, **47,** [2443], 806—808.

The skins of the younger kids require much delicacy in handling and are used for the finest qualities of gloves ; the stronger qualities are made of either kid or lamb skin, from year old animals. The chief sources of kid skins are France and Bavaria, whilst many lamb skins come from Russia and Arabia ; they are stocked in June and kept for about a year before working. One skin yields two pairs of ordinary gloves, each glove is composed of 15—19 pieces, irrespective of the fastening.

Dressing.—The skins are taken from store and soaked in clean water for 2 or 3 days according to thickness, they are "unhaired" by (1) immersion for 2 days in a weak and for 7 to 10 days in a strong solution of lime and sodium sulphide. The wool of lamb skins is less easily removed, they are then (2) treated on the fleshy side with a paste of the same composition as the solution, but more concentrated, rolled up and stacked for 9—14 days. (3) the skins are then washed and the hair removed by hand on a sloping "horse" with a double-handled, curved blunt knife. They are trimmed, turned over, and the fleshy particles scraped off with a knife. For graining, the skins are again reversed and pressed out, still upon the "horse," in all directions by a special tool like a scraper. They are then churned with water, 1,000 at a time, for 20 mins. and soaked in a bran bath at 25° C. for 3 hours and again churned with a solution of alum and sodium chloride. After churning for half an hour, flour and yolks of eggs are introduced and the operation continued for an hour, they are then taken out, folded with the grain inwards and dried at a temperature of 40° C. They are next dipped in water, hammered and drawn out in all directions on a semicircular "staking knife," dried, crumpled up together and stamped upon by men with bare feet, again stretched, packed and stored for 6 months to 2 years.

Dyeing.—The various colours are obtained almost exclusively with combinations of Campeachy wood, Pernambuco wood, and Fustic wood, giving blue, red, and yellow dyes respectively. The skins are dyed whole, they are first stamped upon in a bath composed of yolk of eggs and water. For light shades no mordant is employed and the skins are simply dipped, but for dark shades the skins are squeeged on to a zinc slab and a mordant of urine is first applied with a brush, the dye being then painted on in a similar manner, the insides of dark gloves are always left white and only the grain side is dyed. The dyed skins are then piled up, dried and softened by contact with damp sawdust, and stretched on a "staking knife."—J. F. B.

Artificial Leather. P. H. Larsen and H. L. B. Mörck, Copenhagen. Danish Pat. 2497 of Oct. 4, 1898.

One part of finely chopped Italian hemp and ½ part of coarse, scoured wool are carded together to form a wadding. This wadding is packed between linen and felted by treatment with hot, acid vapours. The felt is washed and dried, and impregnated with a mixture which varies according to the nature of the leather to be made. For instance, for a sole leather the following mixture is made:—50 parts of boiled linseed oil, 25 parts of rosin, 25 parts of French turpentine, 10 parts of glycerin, and 10 parts of vegetable wax. The ingredients are mixed and warmed on a water-bath with ammonia water. When the mixture is homogeneous, 25 parts of glue, which has been soaked in water, are added, together with a solution of caseïn, prepared by dissolving 50 parts of moist precipitated casein in a saturated solution of 16 parts of borax, and then adding 10 parts of potassium bichromate. The mixture is boiled to a thick consistency, and the felt is impregnated, dried at the ordinary temperature, placed in a solution of aluminium acetate, and finally dried and pressed.—J. F. B.

Copper, Solubility of, in Gelatin Solution. A. Lidow. J. russ. phys. chem. Ges. **31**, 571—572; Chem. Centr. 1899, **2**, [9], 471.

By examining the action of copper salts on alkaline solutions of albumins, the author has become convinced that the biuret reaction is due to some copper being dissolved, the copper salt being reduced to soluble colloidal copper. To confirm this view, the author allowed 39·487 grms. of bright copper gauze to stand in contact with an alkaline gelatin solution (13·6 grms. of gelatin, 14 grms. of caustic potash, and 150 c.c. of water). After 48 days it was found that 3·54 per cent. of copper had gone into solution.—A. S.

Albuminoids, The Reversible Liquefaction of. Tsvett. Comptes Rend. **129**, [15], 551.

See under XVIII. A., *page* 1045.

Tanning Materials, Analysis of. J. Paessler. Deutsche Gerber Zeit. **42**, [116] and [117].

See under XXIII., *page* 1057.

Dung Bate, Action of the. J. T. Wood.

See under Nottingham Section, *page* 990.

XV.—MANURES, Etc.

PATENT.

Artificial Manures, Manufacture of. A. Wenck, Magdeburg, Germany. Eng. Pat. 12,233, June 12, 1899.

With further reference to the process described in Eng. Pat. 4714 of 1899 (this Journal, 1899, 846), the author finds that the spore preparation may be dispensed with, and manures may be produced from nitrogenous waste products by treating them with lime and silica alone. Thus 60 per cent. of molasses spent-wash, dried, and reduced to fine powder by adding 35 per cent. of caustic lime and 4 per cent. of silica, may be employed as manure with or without the addition of one-millionth part of "nitro bacteria spore powder." The silicic acid appears to protect the spores from the action of the caustic lime and to favour the growth of the nitrifying bacteria.—L. A.

XVI.—SUGAR, STARCH, GUM, Etc.

Diffusion [Sugar Cane] at the Lesser Antilles. A. Héliard. Bull. de l'Assoc. des Chim. de Sucr. et de Dist. 1899, **17**, [2], 146—149.

So much has been said against the diffusion process in the French Antilles that it is now the general belief that "it cannot succeed." The failure of three out of the four installations can, however, be attributed to causes quite outside the process itself.

The installation set up in 1888 by an English company at the works of the *Grand Cul de Sac* in St. Lucia was insufficiently equipped, and after working eight days, instead of making the necessary additions, the management returned to the mill.

The contract to pass 250,000 kilos. of canes with a single cane cutter at *Pointe Simon*, in Martinique, in 1889, rendered this attempt abortive, as the quantity was too large, and it was necessary either to be content with poor exhaustion or an insufficient amount of cane worked up.

At *Duquerry*, in Guadeloupe, in 1888, diffusion worked perfectly, but had to be abandoned on account of the ruinous price of canes owing to the smallness of the crop.

The installation by the Compagnie Fives-Lille at *Maquisat*, in Guadeloupe, in 1895, was made under the direction of Alexandre. After the initial difficulties were overcome, matters improved each year. There was a gradual increase in the yield from 10·42 in 1895 to 12·38 in 1899, while the coal consumed per ton of canes worked decreased from 90 kilos. to 55. The latter figure may be reduced much further when two other diffusers are added and the juice drawn off can be diminished. It is maintained that the advantage of this process over that of the mill, besides the increase of yield of at least 1·50 per cent., is that it is easier to work and to control.

The results of the last season at Maquisat were:—

	Per Cent.
Richness of cane	14·80
1st jet	10·68
2nd jet	1·59
3rd jet	0·71
Total	12·38
Molasses	3·36

showing that the gain in extraction is confined to the first jet, and this without recourse to new processes (Steffen or others). The extraction, 95 per cent. of the sugar of the cane, was a maximum for the Antilles, and the molasses a minimum. In fact, the factories working with mills in Guadeloupe give 3·50 to 4·50, while those of Martinique, which are rather molasses works than sugar factories, for a yield of 6 to 8·50 of sugar, give 4·20 to 5·60 of molasses. It is true that the rum they make, which fetches a high price, is some compensation.—L. J. de W.

Starch Sugar (Glucose, Dextrin, Syrup, &c.), Use of Hydrofluoric Acid in the Manufacture of. F. Malinsky. Zeits. f. Spiritusind. 1899, **22**, [27], 240.

Glucoses manufactured from starch by the aid of sulphuric or hydrochloric acid often contain a relatively high percentage of ash, owing to the fact that the salt, formed on neutralisation of the acid used, remains partly ($CaSO_4$) or wholly (NaCl), as the case may be, in the finished sugar. This ash gives rise to various objectionable qualities in the sugar, such as turbidity, a saline flavour, &c.

According to the author, the use of hydrofluoric acid as converting agent (Ger. Pat. 103,592, Dec. 16, 1897) does not give rise to these disadvantages. The calcium fluoride, resulting on neutralisation with chalk, is so insoluble in water and sugar solution, that a *single* filtration suffices to remove it from the juice, so completely, that spectroscopic examination fails to reveal the presence of fluorine in the ash of the finished sugar. It is stated that starch sugars produced in this way contain mere traces of ash, possess a markedly clean flavour, and remain perfectly brilliant during concentration and on storage.

The acid is employed at the rate of 0·5 kilo. of 50 per cent. HF per 100 kilos. of starch, the *modus operandi* being in other respects as usual. The time of boiling ranges from 1—2 hours, according to the quality of the raw material and the degree of conversion required. From the press-cake of calcium fluoride the acid may be regenerated by known methods.—H. T. P.

Reducing Sugar, Inadmissibility of the Use of Basic Lead Acetate for the Clarification of Liquids containing. Pellet. Ann. Chim. anal. appl. **4**, 220—221; and **4**, 253. Chem. Centr. 1899, **2**, [8], 453; and [11], 573.

The author points out that basic lead acetate interferes with, and if present in sufficient quantity, destroys the optical rotating power of reducing sugars. He recommends the employment of neutral lead acetate, assisted, if necessary, by solution of bleaching powder.

The influence of neutral and basic lead acetate on the polarisation of sterilised must was also examined. The polarisation remains unaltered by the addition of neutral lead acetate, but becomes lower with the basic acetate. The reducing power remains unaltered by the addition of basic lead acetate.—A. S.

Starch Solution, Preparation of; Re-formation of Starch Granules from the Solution. H. Rodewald and A. Kattein. Chem. Centr. 1899, **2**, [8], 419.

See under XXIV., *page* 1062.

Farina (Potato Starch) Valuation of. C. Saare. Leipziger Färber und Zeugdr.-Zeit. 1899, **48**, [8], 323 and 335—337.

Potato starch is sent into commerce in several grades of quality. The best is known as "Superior," and can be made only in large manufactories, smaller ones obtaining as their first and most valuable fraction (which subsides in the process of preparation) "Prime Deposit" or "Prime" starch. The granules of the first of these are about 35·5, those of the second about 32·5 mmm. (micromillimetres) in diameter. After these comes a series of products of less value, the quality of which is indicated by the numbers 1 to 7, and the granules in which are from 17 to 12·5 mmm. in diameter.

The starch is obtained in the form of granular clusters or "crystals" by placing it in the moist state between covers on frames and allowing it to dry at rest. It is preferred in this form, especially in England, to the powdered product, owing to an impression which exists that it is purer than the latter. When it is dried upon endless bands, the starch is obtained in smaller clusters and is termed "Finishing Starch." The ground and sifted potato starch is sometimes known as "Potato Flour."

Potato starch should exhibit the following external characters:—(1) It should have a pure white colour. Slight tinges of yellow, blue, or grey detract from its value. In judging the colour, the sample should be compared side by side with a sample of known good quality. (2) It should be free from any acid taste or smell. Its peculiar smell is due to the presence of ethereal oils, which may be removed by treatment with alcohol. A sour smell denotes defective treatment in preparation, and renders the starch of less value as a foodstuff. (3) It should have a bright lustrous appearance. The larger the granules the more lustrous do they appear.

The number of specks of dust, &c., in a definite quantity of it is a criterion of the value of the starch. They may be determined by spreading the starch in a smooth, even layer upon paper and counting them in 1 sq. centimetre.

A stipulation regarding the absence of chlorine from starch, sometimes made in commercial contracts, is wholly unnecessary, as that element is never found in the free state in starch as at present manufactured.

The presence of acid is detected by the addition of a few drops of a dilute, neutral, alcoholic solution of litmus. Its amount is estimated by taking 25 grms. of the starch, mixing with it 25—30 c.c. of water and a little litmus solution, and adding a decinormal solution of caustic potash until the mixture has the same colour as a mixture in the same proportions of a sample of neutral starch, water and litmus solution. According to the amount of alkali needed, the starch is classed as slightly acid, when 5 c.c., as acid, when 8 c.c., or as very acid, when more than the latter quantity of the alkali solution is required to neutralise 100 grms.

The quantity of water present varies from 13 to 30 per cent. 20 per cent. is commonly taken as an average amount, but 21 per cent. is more accurate. It is determined by drying a sample at 50° C. for 1 hour, then at 120° C. for 4 hours. The result is correct to within $\frac{1}{10}$ per cent. The amount may be estimated by a method based on the difference in density between dry potato starch ($d = 1·65$), and water, a weighed quantity of the starch being placed in a vessel of known weight and capacity which is then filled with water and weighed. A mixture of certain definite quantities of alcohol and water may also be employed for the purpose. The density of this is determined before and after a known weight of the starch is added to it. The method, however, is not very exact.

No satisfactory method is known for estimating the thickening and stiffening powers of starch.—E. B.

Gum from Certain Species of Mesembryanthemum ("Gomme Vierge Vegetale"), Use of, in Calico Printing. Achon-Bitz. Rev. Gén. Mat. Col. 1899, **3**, [33], 317—318.

The plants *"Edule Lineo"* and *Acinaciformis Lineo*, which have been introduced into the South of France from South Africa, bear a fruit which yields a valuable gum. This is known as virgin gum, from the fact that so long as the capsule, which contains it is unbroken, the gum remains perfectly clean, and thus differs from gum-arabic and similar gums, which are much exposed to the air before being gathered, and which thus become intermixed with sand, dust, insects, microbes, &c.

Virgin gum is extracted by means of a press, specially constructed for the purpose. The capsules are submitted to three pressings. The product first obtained is a colourless liquid with an agreeable taste, free from smell, and very rich in arabin. It is evaporated to dryness, losing about half of its weight in the process, and may be obtained in the form of bright, clear, colourless masses of any shape or size desired. It cannot be admixed with other gums for the purpose of sophistication, as any admixture with it is easily seen. The second pressing gives a liquid which is of the same strength and consistence as that first obtained, but which has a pale yellow colour, while the third pressing yields a viscid syrup of a dark brown colour and sour smell.

The gum appears to be identical in composition with gum-arabic. On account of its great purity, it should be employed in preference to other gums by pharmacists, confectioners, distillers, lace manufacturers and others.

The product of the third pressing is suitable for most industrial purposes for which gum is used: the manufacture of matches, ink, blacking, postage stamps, furniture polishing, &c.

In calico printing, the newly discovered gum gives brighter and fuller shades than gum-arabic.—E. B.

Invert Sugar in Presence of Cane Sugar, Estimation of. Jessen-Hensen. Carlsberg Laborat. Medelelser, 1899, **4**, 314; through Chem. Zeit. Rep. 1899, **23**, [28], 273.

See under XXIII., *page* 1058.

Golden Syrup, Analysis of. R. Bodmer, N. Leonard, and H. M. Smith. Analyst, 1899, **24**, [10], 253.

See under XXIII., *page* 1058.

PATENT.

Starch and Saccharine Matters, Production of. C. F. Cross, London, and J. S. Remington, Lancaster. Eng. Pat. 1035, Jan. 16, 1899.

The process claimed is the manufacture of starch from horse-chestnuts, by grinding the fresh fruits or by steeping the dried fruits in warm water and then grinding; the ground pulp is stirred up with fresh water, and strained through fine sieves. The starch settles out in a commercially pure state from the liquid passing through the sieve, and the residual pulp is mixed with the steeping liquors, which contain soluble carbohydrates, and the whole is digested with dilute sulphuric acid, yielding a saccharine liquor which may be concentrated or fermented directly with yeast.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, Etc.

Beer Yeasts, Comparative Investigation of Four Low-Fermentation. H. Will. Zeits. für d. ges. Brauw. **22**, [12], 151—166; [13], 167—175; [14], 185—188; [15], 197—200; [16], 207—212; [17], 223—226.

Among the conclusions formed by the author from the lengthy researches detailed in the paper, may be mentioned the following:—

The form of growth assumed by the colonies on solid media, is influenced by the origin of the mother cells, the age of the colonies, and the nature of the cells sown; also by the composition and physical characteristics of the liquid medium previously employed, the temperature of both cultures, the aeration, the degree of moisture in the damp chamber, and, in some cases, the thickness of the stratum of gelatin. Three different types of growth are met with: the regular (mulberry), semi-irregular (with regular core), and the totally irregular; and the susceptibility to variation in form under the influence of different substrata is in inverse proportion to the length of time the yeast has been grown under constantly uniform conditions, these tending to produce fixity of type. Irregularity of growth on the part of film yeasts can be corrected by frequent re-inoculations, whereby the tendency to produce films can apparently be eliminated.

As they come to maturity the colonies alter from their initial form, the principal factors being aeration and the thickness of the sowing; aerobic generations are produced, and (given thin sowing) the colonies come to maturity the sooner and more luxuriantly in proportion as the gelatin stratum is thinner, and as the colonies are nearer the surface. Colonies from sedimental yeast exhibit two distinct phases in maturing, oval cells being produced in the earlier stage, and elongated (sausage-shaped and mycelial) forms in the second phase both on wort-gelatin and beer-gelatin media. The yeasts that easily yield film generations in liquid media exhibit a tendency to very early maturity on solid substrata and *vice versâ*, and in fact the behaviour noted, indicates that film formation, modified by the altered conditions, also occurs when solid media are employed.

Colonies grown on wort-gelatin retain the original form of growth far more tenaciously than cultures on beer-gelatin. Pure cultures of film-yeast cells in wort yielded, after oft-repeated re-inoculations, sporogenic sedimental cells, this tendency increasing with the number of colonies exhibiting the regular type of growth. It would seem that beer-gelatin is more suitable than wort-gelatin for facilitating the recognition of the specific form of growth exhibited by the first generation of film cells. Film cells of the second generation (mycelial form) retain their specific characteristics after successive re-inoculations of the pure cultures in suitable liquids during several years, thus showing this stage of development to be an independent generation, differing in character from all others. Two forms of growth may arise; in one the mother cells throw out rounded or flattened oval lateral members which ultimately develop into the regular form of growth; whilst in the other, only lengthened oval and sausage-like cells are produced, these growing into a loose network. Repeated re-inoculation, of these second generation film cells (on solid media), however, finally yield a predominating quantity of rounded cells of the regular type of growth.

In the case also of "resting cells" (spores), the phenomena and forms of growth of the colonies are various, and the colonies very soon separate sausage-shaped and mycelial cells, whereby they may be distinguished from those grown from sedimental yeast, and film cells of the first generation. The colonies growing according to the regular type, do not exhibit two distinct phases in coming to maturity.

Confirmation is afforded (by these researches) of the opinion that the variations in the form of growth of the colonies obtained by sowing cells from old film-producing cultures, are closely connected with the different generations appearing in the course of the development of the cultures.

The diagnostic value of the form of growth assumed by individual cultures on solid media, is very low so far as concerns the differentiation of species or races of yeast, though it affords some guidance for the characterisation of the different generations occurring during the cycle of development of a particular species; and the author believes that in many cases where so-called new races of yeast are produced, it is really only a matter of different generations and stages of development, with their correspondingly divergent peculiarities.—C. S.

Yeast, Process for Obtaining the Protoplasm of. E. de Meulemeester, Brussels. Ger. Pat. 105,629, Oct. 26, 1898, through Woch. für Brau. 1899, **16**, [38], 490—491.

The yeast is washed, sifted, pressed, and mixed with powdered gum-arabic, which absorbs the moisture remaining in the yeast and becomes liquefied; the mixture is kept at a suitable temperature, which may be between 4° and 30° C. According to the nature of the yeast used, the manipulation of the mixture is regulated so that, for instance, 1 kilo. of pressed yeast of high fermentative power and 120 grms. of gum arabic are completely liquefied in three hours if kept at a temperature of 15° C. Four hours after mixing, the mass begins to ferment and swells up considerably with evolution of carbon dioxide. Vigorous fermentation proceeds for 12—15 hours, and 10 hours later it subsides and the fluidity of the mass is seen to be greater than before fermentation. The time required for the processes of liquefaction and fermentation depends on the temperature of the mixture, the condition of the yeast and the quantity of gum arabic used, the operation may last from 36 to 80 hours. The yeast cells are now observed to have shrunk considerably, and the protoplasmic contents have been removed according to the laws of osmosis. The mixture is next digested on a water bath and kept at a temperature of 70°—90° for 12—20 hours in order to complete the extraction and separate the exhausted cell-membranes. The product after dilution and filtration can then be applied either for the inversion of sugar or for the preparation of food extract after concentration to a syrup.

—J. F. B.

Beer Yeast, Preparation of Expressed Extract from Bottom-Fermentation, at the Berlin Experimental Brewery. R. Albert. Woch. für Brau. 1899, **16**, [38], 485—488.

The author has studied the properties of the extract expressed from the yeast in daily use at the Berlin Experimental Brewery, more especially with the object of comparing them with those, published by Buchner and Rapp, of the extract of Munich yeast. Proceeding exactly according to the directions of these investigators, the extract of Berlin yeast fell very far behind that of the Munich, both in yield and fermentative power. Subsequently, by pressing a kilo. of yeast in two portions and leaving under pressure for an hour, it was possible to obtain 500 c.c. of extract from 1 kilo. of yeast, using 140 c.c. of water for the second pressing. It was found that the extracts prepared on different days from yeast of the same origin, and apparently in the same condition, varied greatly in fermentative power, but even the highest value was much lower than those for Munich yeast. Except in one case, the extract obtained from the second pressing (after trituration with water) was always far weaker in fermentative power than the extract from the first pressing, although the specific gravities of the two differed but slightly. The fermentative power of the extracts diminished very rapidly on keeping, a distinct decrease being observable after 15 hours at 0° C. Contrary to Buchner and Rapp's experience, the author always found a great diminution of fermentative power on drying his extracts, but the activity of the dried extract remained constant for 3—4 months. The above facts point to the presence of a large proportion of very active proteolytic enzyme in the Berlin yeast as compared with the Munich yeast. Like the Munich extracts, the average proportion of solid matter in the Berlin extracts was about 14 per cent. The latter always had a strongly acid reaction a condition which is often favourable to digestive enzymes; the author, therefore, neutralised the extract before evaporation, but a still greater destruction of zymase took place than in the case of the acid liquid. Wedemeyer has shown that thymol has a considerable paralysing effect on the digestion of proteids by pepsin and the like. The author therefore tried the effect of evaporating the extract in presence of a little thymol, and found that an improvement of about 50 per cent. was obtained by this preservative. The action of thymol as a preservative in determinations of fermentative power, in place of toluene which is generally used in Meissl's method, was also tried, with the result that higher values were always obtained in presence of thymol.

Investigations were made as to the nature of the free acid present in the extract; the proteids were precipitated by alcohol, and the volatile acids of the evaporated filtrate were obtained. The principal constituent of the volatile acid was recognised as formic acid, and it is suggested that the reducing property of yeast extract may be due to the presence of free formic acid.

Hayduck (Woch. für Brau 1884) described a process by which yeast, which had lost its vigour in the brewery, could be regenerated by allowing it to ferment a solution of sugar containing little or no nitrogenous matter. The cause of the enfeeblement of the yeast was traced to an excessive assimilation of nitrogen which prevents further activity in nitrogenous wort, and this excess is worked off in the solution of pure sugar. The author applied this method of Hayduck to some of the brewery yeast, and found that after regeneration, an extract could be obtained with a greatly increased fermentative power. The excessively nitrogenous yeast is more powerful in solutions of pure sugar than the regenerated yeast, whilst in wort the reverse is the case; but since the author shows that the regeneration is accompanied by increased storage of zymase, it would seem that the fermentative power of living yeast depends, not so much on its actual zymase-content, as on its vital activity and ability to form new zymase. The first experiments on regeneration were made with 8 per cent. sugar solution for 24 hours at the ordinary temperature. On varying the conditions the author found that temperature had no effect on the increased storage of zymase, but that concentrations of 16 to 22 per cent. of sugar were very favourable. He also found that the zymase-content decreased at first, and that the minimum corresponded with the period of maximum activity of the regenerative fermentation, but that the zymase stored increased later on, and was at a maximum after 24 hours, after which it did not change. During the regeneration the yeast apparently derives its nitrogen from its own substance, as seldom more than 70 per cent. could be recovered after the process. The regenerative fermentation is also accompanied by formation of glycogen which, however, again disappears after the fermentation is completed.—J. F. B.

Yeast, Auto-Fermentation of. C. J. Lintner. Seventy-first Meeting of the Soc. of German Scientists and Physicians, Munich, 1899; through Chem. Zeit. 1899, 23, [80], 850.

The fermentation by yeast of its own substance undoubtedly takes place chiefly at the expense of the glycogen contained by it, and the unfermentability of added glycogen is only due to the fact that it cannot diffuse into the yeast cells, and no enzyme is excreted for its hydrolysis. Cremer (this Journal, 1899, 777) showed that expressed yeast extract could form glycogen from added sugars; this is then converted into glucose and fermented to alcohol and carbon dioxide. If yeast be treated with sodium chloride, the auto-fermentation is suppressed, whilst the glycogen is found as glucose. The auto-fermentation of fresh yeast in presence of sodium sulphate yielded 7·7 and 5·6 per cent. of alcohol on the dry yeast in 42 hours. A characteristic of auto-fermentation is the production of fruity ethers; the power of fermenting sugar is not diminished, but, according to Hayduck, rather increased by keeping the yeast for several days. The author has observed that by mixing the fresh moist yeast with salts, the auto-fermentation was increased in some cases and diminished in others. 10 grms. of fresh yeast, which was rich in glycogen, were ground up with 5 grms. of mineral salt, and the intensity of the fermentation was noted. Chlorides were found to hinder the auto-fermentation. The effects of sulphates varied according to the nature of the base; potassium bisulphate stopped the fermentation; zinc and magnesium sulphates stimulated it; ferrous sulphate was favourable; copper sulphate, and more especially manganese sulphate, had retarding effects. Dibasic sodium phosphate was unfavourable, but mono-basic potassium phosphate increased the fermentation. Ammonium salts retarded it, as also did nitrates; distilled water delayed the fermentation at first. Smaller proportions of salts showed throughout a stimulation of the fermentation as compared with water. The author is inclined to think that the influence of the salts is due to a dehydrating action on the yeast plasma, thereby stimulating it to increased activity. When the dehydration exceeds a certain amount, as in the case of chlorides, the action of the protoplasm is paralysed. He does not consider that Buchner's theory of fermentation is definitely proved.

—J. F. B.

Oat Malt, Investigations on. Delbrück. Zeits. für Spiritusind. 1899, 22, [41], 375—376.

There is a difference of opinion between theory and practice with regard to the value of oat malt. Practical men say that its use makes the mash more liquid, reduces the rise of the fermenting liquid, and prevents foaming fermentation. It has been suggested that these effects may be due to a high fat content; but, although it is true that raw oats contain about twice the quantity of fat as barley, this is probably largely consumed in germination. The author suggests a series of experiments to be performed by distillers to settle the question: 1st. To test the efficacy of raw oats, as compared with malted oats, and see whether their higher fat content has the effect with which it is credited. He himself does not believe that the advantage is due to fat. He says, that foaming fermentation is not in itself an evil; it simply indicates too rapid a diastatic action and conditions of fermentation, which are excessively favourable. He believes that the so-called advantages of substituting oat malt for part of the barley malt, will be found to be due to a slower saccharification, by reducing the quantity of diastase which is now used in excess. The 2nd experiment is to compare the effect of reducing the quantity of barley malt used per mashing, with that of the mixed barley and oat malts, and he expects that equally good results as regards foaming will be obtained. 3rd. To see whether the use of oat malt really does give a better attenuation than barley malt, or whether the better attenuation claimed by some is not due to errors introduced by the presence of fat on the apparent specific gravity of the fermented wash; for this purpose the alcohol should be estimated by distillation.—J. F. B.

Beer, Malt Adjuncts in; Limits of Detectability of. E. Prior. Bayer. Brauer-J. 1899, [26]; Allgem. Zeits. für Bierbrau. 27, [30], 695—697.

The author's investigations lead him to conclude that:—

The addition of starch and rice increases the time required for saccharification, erythrodextrin being detectable at the end of 1 hour when 20 per cent. of starch has been used.

The percentage of maltose and reducing achroo-dextrins in the unfermented extract is somewhat increased when 20 per cent. of starch or rice has been added, though 10 per cent. of these materials does not affect the result.

The percentage of nitrogen in the extract from unfermented work is reduced appreciably by the presence of 10 per cent. of starch, and to less than one-half by 20 per cent., though the addition of similar quantities of rice has no such effect.

The degree of attenuation of the beer is slightly lowered by 10 per cent. of starch, and appreciably so by 20 per cent., whilst rice exerts a slight influence to the contrary.

Both starch and rice (the former more especially) increase the proportion of maltose and reducing achroodextrins in the beer extract.

The nitrogen content in this extract is but slightly below 1 per cent., but is never lower than 0·9 per cent., after an addition of 20 per cent. of starch. Rice, on the contrary, increases the proportion of this element.

Consequently, the adoption of 0·9 per cent. as the minimum permissible percentage of nitrogen in the extract of pure malt beers, is not calculated to reveal the presence of malt adjuncts, unless perhaps in special cases where the degree of attenuation is extremely low and nitrogen-free starch preparations have been employed.—C. S.

Frohberg Yeast and S. Pastorianus III., Struggle between, under Various Conditions. G. Syrée. Cbl. für Bakteriol. Abt. II. **5**, 6; Zeits. für d. ges. Brauw. **22**, [18], 242—245.

The object of these researches was to observe the course of fermentation, and estimate the resulting products (especially alcohol and acids) of the yeasts in question in a saccharose-yeast-water medium.

About 3,000,000 cells of each yeast were employed in each inoculation, and the fermentations were conducted at 25° C. and 5°—6° C., the medium being well shaken up twice daily to facilitate the distribution of the cells. At the higher temperature, Frohberg yeast proved superior to Pastorianus in reproductive energy (four days) and reproductive capacity, the converse being the case at 5°—6° C., thus confirming the results of Munsche with regard to other wild yeasts.

As regards the amount of saccharose fermented in four and eight days, Frohberg led in the high-temperature series (the rate of inversion being quicker), but not in the other, though in both, the final results worked out in favour of Pastorianus. In fermentative energy and power, per million cells, however, the latter yeast proved superior to its rival at 25° but inferior at 5°—6° C., a result which, combined with the rate of reproduction observed from single cells, confirms the axiom that energy and capacity of reproduction vary inversely with fermentative energy and power.

The alcohol produced was greatest throughout in the case of Pastorianus, as also the quantity of acid, though at first, in the high-temperature series, Frohberg led in point of acid production. This property of Pastorianus yeast would have considerable influence on competitive yeasts susceptible to acids.

A slight addition of Pastorianus considerably lowered the reproductive energy and capacity of Frohberg, at 25° C., but these properties were increased in the mixture when larger proportions of the first-named yeast were employed, a result principally due to the activity of this component. It seems probable that if Pastorianus constituted 25 per cent. of the mixture at the outset, it would predominate in the ensuing struggle for existence, since the Frohberg yeast proved incapable of suppressing an initial proportion of $\frac{1}{200}$th of Pastorianus. Under these latter conditions, the rate of reproductive increase per cell proved minimal, whilst the fermentative power reached the maximum.

Small additions of Pastorianus retarded the production of alcohol at first, but by the 28th day the conditions were reversed, and larger additions had a favourable effect, the maximum production being obtained with $\frac{3}{4}$ Frohberg and $\frac{1}{4}$ Pastorianus. Parallel results were obtained, as regards acid production, in the high temperature series, but at 5°—6° C., the quantity obtained approximated closely to that furnished by Frohberg alone. The maximum output of acid and alcohol per 1 million cells was obtained by mixtures containing $\frac{1}{200}$ of Pastorianus; and in all instances at 25° C., the production exceeded that from Frohberg alone, though with one exception ($\frac{1}{200}$ Pastorianus) the reverse was the case in the low temperature series.

In a special series of experiments on the persistency of Pastorianus in presence of Frohberg, it was found that whilst in the earlier stages, at 25° C., the former is kept under, it subsequently increases progressively; and in low-temperature fermentations goes on increasing from the outset.—C. S.

Symbiotic Fermentation. A. Calmette. Chemist and Druggist, 1899, **55**, [1026], 514—515. Read before the British Association, Sept. 1899.

The author states that the fungi act by means of the diastases, which they secrete, and which have properties very similar to those which the higher plants or animals possess for the assimilation of their foods; the diastase produced differs according to the nature of the food available. Thus the *Pencillium glaucum*, under different conditions, is capable of secreting sometimes amylase, sometimes sucrase, or sometimes rennet and casease. When these organisms are allowed to develop (*e.g.*, on a piece of potato), it often happens that other beings, bacteria, or moulds, whose functions are different, are not long in settling down beside them, and taking part in the work of molecular degradation commenced by the first occupant. In this way, in fact, a piece of potato may be split up, by successive decompositions, into carbon dioxide and water.

The fermentative properties of the moulds are much less developed than their saccharifying properties, and they seem to prefer to work along with alcohol yeasts. The author considers that if they are carefully trained and used in pure cultivation and only along with pure cultivations of yeast, that by this means, the direct fermentation of starch, grain, or potatoes could be brought about, thus doing away with the malting process.

Sir H. Roscoe pointed out that, at the present time, thousands of tons of starch are transformed into alcohol in France and Belgium by the employment of pure cultivations of the two forms of organisms. It is stated that under efficient scientific supervision as much as 97·5 per cent. of the theoretical yield of spirit may be obtained, of superior quality to that produced in the ordinary way.

H. E. Armstrong advocated Baeyer's view, that fermentative changes are due to the withdrawal of water and the subsequent addition of its elements in a different order, the function of enzymes being to bring the water to this particular condition of activity.—A. S.

Fermenting Wort (Kräusen) and Yeast, Relative Utility of, in Conditioning Beer. E. Ehrich. Der Bierbrauer, 1899, [7]; Allgem. Zeits. für Bierbrau. **27**, [31], 719—721.

The conclusions drawn by the author are that yeast is only useful as a substitute for fermenting wort (kruäsen) when the beer to be conditioned still contains a sufficiency of fermentable constituents, and the secondary fermentation has become sluggish owing to the unfavourable nature of the sediment; otherwise the only efficient substitute is wort or a mixture of wort and yeast. This latter mixture will also satisfactorily replace "Krausen" as a clarifying agent, which yeast, alone, is incompetent to do.

Consequently, where the beer requires outside assistance in conditioning, and the flavour imported by "Kräusen" or mixed wort and yeast is undesirable, the gravity of the beer should be tested to ascertain whether enough fermentable material is present to enable yeast to effect the purpose in view; in doubtful cases, the effect of added yeast on the final attenuation should be tested by pitching and forcing a small sample.—C. S.

Aeration of Fermenting Wort; Time for Maturing Beer, &c. K. Michel. Allgem. Zeits. für Bierbrau. **27**, [37], 877—881.

In the course of this paper the author refers to his researches on the aeration of fermenting wort, the results of which go to show that the reproductive power of the yeast is thereby increased without any considerable alteration in the degree of final attenuation. The results were practically the same whether open-, closed-, or vacuum-fermentation vessels are employed, the only advantage in the last-named being an economy of space, owing to the larger size of the individual tuns.

He also finds that the time required for maturing beer is in inverse ratio to the amount of hops used.—C. S.

Brewing, Fermentation, "Break," and Attenuation. Allgem. Zeits. für Bierbrau.; La Bière, **7**, [8], 115—117.

In seeking to remove the defects of a beer exhibiting unduly high attenuation, coupled with an absence of "break," the method of malting, kind of brewing water, and the various operations of brewing were carefully investigated to ascertain the cause. Finally, a modification of the Windisch abbreviated mashing system was found to give satisfactory results. The change consists in starting with a less concentrated mash, saccharifying the first thick mash for 15 minutes at 70°—75° C., and then boiling 15 minutes, instead of 5, after allowing the mixed mash to saccharify 15 minutes in place of half an hour. The boiling of the clear mash was prolonged to 15—20 minutes, the heating up being effected quickly.

It was found that the Windisch method is best suited for easily convertible malts, there being in other cases considerable risk of gelatinisation.—C. S.

Head [Beer], Influence of the Method of Brewing, on. F. Bousquet. La Bière, 7, [8], 113—114.

In testing the abbreviated mashing process advocated by Windisch, Schuber obtained better results with malts rich in sugar than with those poorer in this constituent, which circumstance confirms the inference drawn from the labours of Wahl and Henius, *viz.*, that the permanence of "head" on beer is due to the presence of dextrins, and not to albumose. The worts hardly drop so bright as those from the triple-mash method, nor do they "break" so well; but the colour is lighter, and the wort ferments well, and holds the "head" satisfactorily. In point of flavour, no difference could be detected. In view of the saving in time, fuel, &c., the abbreviated method therefore appears advisable for the production of pale beers from forced malt.—C. S.

Pitch, Brewers', Proper Degree of Heating. Allgem. Anzeig. für Brau. 15, [30], 1156.

In view of the different melting points and degree of fluidity of the various kinds of pitch used for lining casks, it is advisable for makers to determine these qualities, so as to enable the user to employ the pitch to the best advantage, and secure the maximum fluidity without the waste resulting from over-heating. In any case, the temperature should not be lower than 130°—140° C., or exceed 180°—200°, and the heating should be controlled by a thermometer.

An insufficiently considered factor in this operation is the temperature of the cask, since when the latter is already warm, through the removal of the old lining by burning or steaming, the pitch need not be so hot as when it is required to dissolve the existing layer in the cask. Under the latter conditions, the pitch employed should be able to stand a higher temperature and attain a greater degree of fluidity than is otherwise necessary.—C. S.

Attenuation Theory, Researches in Balling's. A. J. J. Vandevelde. Bull. Assoc. Belge des Chim. 13, [6], 293—299.

The author has arranged in a table, according to the method employed by Galton, the results of 220 determinations of alcohol (in distillery wort) estimated by the Balling method, the corresponding amounts actually determined, and the differences between the two sets of results. From the curves plotted on the basis of these data, he obtained the following mean values:—

Calculated weight of alcohol	4·26
Actual „ „	3·03
Difference	1·13

the latter agreeing very closely with the difference (1·23) obtained by subtraction. He therefore fixes the mean error of the Balling method at $x = \frac{100 \times 1\cdot13}{4\cdot26} = 26\cdot5$ per cent.; from which he concludes that the attenuation theory, however valuable it may be in affording indications as to the relative progression of fermentation, is inapplicable as an analytical method for the estimation of alcohol; nor would an attempt to reduce the mean error by employing a correction factor render any assistance, owing to the great irregularity of the differences between the alcohol calculated and that actually found.—C. S.

Transitory Starch, Dependence of the Formation of, on Temperature and Oxydasic Action. J. Grüss. Woch. für Brau. 1899, 16, [40], 519—524.

In his experiments, the author noted the time required under different conditions of germination for starch granules to spread in the bud-sheath, and to appear in the *calyptra*, which in the quiescent stage is always free from starch; the observations were made on excised barley embryos growing on moist filter-paper. The results showed that a supply of free oxygen is necessary for the formation of starch. Starch formation at the expense of the cane sugar only begins to take place some few degrees above 0° C., and then proceeds very slowly. At low temperatures the growth of the granules is very limited and they appear isolated, first in the bud-sheath, then in the base of the primary leaves, in the root-sheath, the scutellum, and finally in the *calyptra*, the root-base, and the hypocotyledic member. At higher temperatures the formation of the granules is more intense, and they are more numerous and bulky, but the order of appearance in the different tissues is the same as above. The maximum temperature is about 30° C. Above 40° C. starch formation is retarded, and the order of orientation is irregular; above 50° C. no starch is formed. The result of germinating the corns at 20° C. and then keeping them at 5°—8° C., has been shown to be manifested in a decrease of reducing sugar. But it is now ascertained that the decrease of glucose does not go to increase the starch formation, but simply to increase the size of the cells, in fact, some of the starch is also consumed for the same purpose, or at any rate its formation is restricted by lowering the temperature.

Three classes of enzymes can be observed by testing potato slices with guaiacum:—(1) The α group of oxydases, which give a blue coloration with guaiacum alone, and which fail to respond to the test after 15 minutes' immersion in alcohol at 50°—53° C. (2.) The β group of oxydases, which survive the treatment with warm alcohol, and give a blue coloration with guaiacum only if the latter be mixed with hydrogen peroxide. (3.) The γ group of diastatic enzymes which still give a coloration with guaiacum and peroxide after treatment with boiling alcohol, at which temperature the oxydases are destroyed. To the α group belong those oxydases which convey free oxygen directly; these are also termed oligo-oxydases, and in the potato are present in the parenchymic tissue and vascular bundles. To the β group belong those oxydases which split off and transfer loosely combined oxygen; they are also termed pleo-oxydases, and occur in the peridermic and bud tissues. The group of diastases act both hydrolytically and catalytically, and are essentially represented by Lintner's diastase which gives the guaiacum-peroxide reaction after 1 hour's treatment with boiling alcohol; the catalytic properties of this enzyme can be suppressed under certain conditions, *e.g.*, careful heating or treatment with ammonium sulphate, &c., its action is then purely hydrolytic. A better test for the oxydases than guaiacum, is tetramethylparaphenylenediamine; it takes up an atom of oxygen with violet coloration. If a split barleycorn be pressed on moistened "tetra paper," the embryo shows the violet oxydase reaction, whilst the endosperm remains colourless. This oxydase, which the author terms "spermase," belongs to the α group, being destroyed by warming with alcohol at 55°—57°, and also by cold alcohol after 24—36 hours' treatment; it differs from other oxydases by only yielding the faintest trace of a coloration with guaiacum, and is not identical, therefore, with "laccase." When moist corns are exposed to the air, the spermase reaction increases in intensity, but at later stages of germination, when the rootlets are visible, the reaction falls off very considerably, possibly owing to the masking effect of reducing bodies formed during germination. The function of spermase is still a matter of doubt, but it probably brings about the formation of starch from cane sugar in presence of air. Spermase is present in the embryos of some kilned malts, but not in the endosperm; the tetra base detects the presence of spermase in the embryo alone, whilst guaiacum-peroxide gives an intense coloration of the endosperm due to the diastase, but only a trace in the embryo.—J. F. B.

Starch Turbidity in Beer. C. Ehrlich. Der Bierbrauer, 1899, [8]; Allgem. Zeits. für Bierbrau. 27, [34], 806—808.

The foundations of starch turbidity may be laid in malting, by too high an initial kiln temperature, which gelatinises the starch and injures the diastase, thus producing steely malt unsuitable for mashing alone or in high proportion with good malt. The remedy in this case is to crush the steely malt very fine, and digest it apart at 70°—75° C., to assist saccharification, the subsequent boiling being prolonged in order to soften and modify the hardened starchy matter. The use of highly kilned malt by itself for dark beers instead of a small proportion of colour malt, may also lead to turbidity, especially if the freshly kilned malt has been binned before it has had time to cool properly. The triple-mash process, commencing with cold digestion (or at temperatures about 40° C.) greatly facilitates the saccharification of such malts as are poor in diastase; but the abbreviated decoction method is less suitable.

The use of a false bottom in the vessel in which the thick mash is filtered is a more frequent cause of turbidity, as the fine particles of solids falling through and collecting on the bottom of the pan cannot be altogether drawn off, some portions becoming dissolved in the filtered wort and added liquor, and so escape conversion. This may be remedied by dispensing with the false bottom during mashing and adding sufficient liquor to cover the strainer before proceeding to filter the wort. Inefficient rakes may also lead to turbidity, by leaving the grains in a lumpy condition, whereby some portions of the starch are left unconverted.

Should the iodine test reveal the presence of starch in the beer, an addition of cold malt extract (10 grms. malt per hectolitre of beer) should be allowed to react on the beer for eight days; and in cases of sluggish secondary fermentation an addition of yeast or fermenting wort will be advantageous.—C. S.

Wine-must, Clarification of, by Tannin and Gelatin. F. Jean. Rev. Chim. Indust. **10**, [117], 245—247.

The author finds that the astringent matters in wine-must are composed of two acids, one of which (œnotannic acid) is analogous to tannic acid, whilst the other (œnogallic acid) is incapable of precipitating albuminoids or gelatin. Furthermore, that the acids of wine dissolve a certain proportion of albumin tannate, which probably then plays an important part in the ordinary white wines so liable to become ropy, &c., though rendered harmless to champagne by reason of the higher content of alcohol and carbon dioxide in this wine.

To ascertain how much of the added tannin is precipitated by the albuminoid matters in the must, and, consequently, how much gelatin must be added to throw down the residual tannin in solution, the author proposes the following method, the ammoniacal zinc acetate test recommended by Salleron being unsuitable in presence of œnogallic acid:—

Ten c.c. of the wine are titrated by iodine solution, the volume consumed corresponding to the œnogallic acid and other matters acting similarly on iodine. Another 100 c.c. of the same must are agitated with 0·1 grm. of tannin, and filtered, 10 c.c. of the filtrate being then titrated with iodine solution. By deducting the results of the first titration from the second, the volume of iodine solution corresponding to the residual tannin in solution is obtained, and from this the amount of tannin rendered insoluble per litre of must can be calculated. As experimental data show that 82—83 grms. of tannin will throw down 100 grms. of fish gelatin from solution, it becomes easy—the amount of tannin rendered insoluble per litre of must being known—to calculate the quantity of tannin necessary to clarify the must.—C. S.

Wine containing Tannin aad a Ferrous Salt, Peculiar Behaviour of a. J. Bellier. Ann. Chim. anal. applic. **4**, 257—259; Chem. Centr. 1899, **2**, [11], 569.

The author examined a tolerably dark yellow so-called "white wine," that turned dark violet-red on addition of alkalis. The wine gave, with a very dilute solution of ferric chloride, first a blue coloration and then a blue precipitate; with potassium bichromate, it was coloured brownish-red. The colouring matter of the wine could not be extracted by ether. The peculiar astringent taste of the wine indicated contamination with iron, and this was found to be the case, a tolerably large quantity of a ferrous salt being present, together with a considerable amount of tannin. These two substances can therefore exist in wine in presence of one another, without the ferrous salt becoming oxidised, and an ink being formed.

Red wine containing a ferrous salt does not become green on addition of alkalis, but remains violet-red.

The presence of iron in the wine might perhaps have been caused by a nail in the cask, and that of tannin by the use of a new oaken vessel.—A. S.

Wines, Non-Alcoholic. P. Süss. Pharm. Central-H. 1899, **40**, 529; through Chem. Zeit. Rep. 1899, **23**, [28], 274.

The author communicates analyses of the non-alcoholic grape-wines made by the "Nectar" Co. at Worms:—

——	White.	Red.
Specific gravity at 15° C.	0·0588	0·0525
Alcohol........................	Traces	Traces
	Grms. per 100 c.c.	Grms, per 100 c.c.
Extract........................	15·416	13·568
Ash	0·348	0·360
Phosphoric acid (P_2O_5)	0·029	0·025
Free acid (tartaric)	0·892	1·065
Volatile acid (acetic).........	0·006	0·046
Glycerin	Traces	Traces
Grape sugar:		
Before inversion	11·590	9·760
After inversion	11·510	9·690
Total nitrogen	0·117	0·108

From 710 grms. of the white wine a deposit of 1·39 grms. of tartar had separated, whilst the red was free from deposit. Strictly speaking, these liquors should not be classed as wines since they are not products of fermentation; they are, in reality, pasteurised grape juice.—J. F. B.

Wines containing Citric Acid. R. Kunz. Zeits. f. Untersuch. Nahr. und Genussmittel. 1899, **2**, [9], 692—694.

Several samples of preparations under the names of "wine composition," "wine substance," "wine essence," &c., have recently come under the notice of the author. Most of these contain, besides tartaric acid, considerable quantities of citric acid. Consequently, since citric acid is not a normal constituent of wine, its presence in wine may be held to indicate adulteration with some of these preparations. As a preliminary test, the method of Denigès (this Journal, 1898, 802) may be employed, but the identification of the resulting precipitate is somewhat uncertain, as it may occur in different forms. The author proposes the following method as being certain and convenient:—50 c.c. of wine are treated with 5 c.c. of a 20 per cent. solution of lead acetate. The precipitate is filtered off with the aid of the pump, thoroughly washed and then stirred up with 50 c.c. of water, and decomposed with 3 c.c. of a 20 per cent. solution of crystallised sodium sulphide. The liquid is clarified with a few drops of acetic acid, the lead sulphide is removed, and the filtrate evaporated on the water-bath. The residue is transferred to a small beaker with a minimum quantity of water, made faintly alkaline with ammonia, and double the volume of ammonium chloride solution is added. Calcium chloride is then added, and after thorough stirring and rubbing with a glass rod, the liquid is allowed to remain overnight until all the tartaric acid has separated as calcium salt. Calcium citrate is kept in solution by the presence of the ammonium chloride; it is detected in the filtrate either by boiling or better by precipitating with alcohol, filtering, washing the precipitate with alcohol, dissolving in a little hydrochloric acid, neutralising with ammonia, and then boiling. The crystals of calcium citrate which then come down are readily identified under the microscope; they occur as whetstone-shaped crystals or sheaf-like aggregates or stars, whereas calcium tartrate crystallises in rhombic prisms. Out of 25 samples of wine examined, the author found 13 containing citric acid.—J. F. B.

Imitation Cognac, The Use of Starch-Sugar in the Preparation of. Omeis. Zeits. f. Untersuch. Nahr. und Genussmittel, 1899, **2**, [9], 703—704.

Many samples of imitation cognac have been met with which have evidently been prepared with starch-glucose syrup. This fact is brought out by a comparison of the two following analyses:—

—	Starch-Glucose Imitation Cognac.	Good French Cognac, Six Years in Cask.
	Grms. per 100 c.c.	Grms. per 100 c.c.
Alcohol	42·74	50·61
Extract	1·005	0·420
Sugar	0·490	0·191
Cane sugar	Nil	..
Dextrin	0·360	..
Mineral matter	0·010	0·011
Acidity (as acetic)	0·093	0·048
	Wild in 200 mm.	
Polarisation direct	+ 2·10	± 0°
„ after inversion	+ 2·10	..
„ after complete fermentation.	+ 1·38	± 0

Fermentation was conducted at 20° C. on 50 c.c. of cognac after evaporation of the alcohol, dilution with water to the original volume, and addition of 2 grms. of pure pressed yeast for three days.

Imitation cognac, not containing starch sugar, may often have an optical rotation of + 0·17° to + 0·5° Wild, in the 200 mm. tube after clarification with lead, but this rotation is due to cane-sugar, and becomes left-handed after inversion, and disappears after fermentation. Imitation cognac which has been prepared with starch glucose also contains an unfermentable dextro-rotatory residue of dextrin, and consequently the non-sugar extract is higher than ordinary cognac.—J. F. B.

Beet-Juices, Suggestions for Obtaining Concentrated and readily fermentable. E. Sorel. J. de la Dist. Francaise, 1899, 169.

The comparative slowness of fermentation sometimes obtaining with highly concentrated beet juices, is ascribed by the author to the presence of heavy metals, derived from the metallic fittings of the plant, by the solvent action of the acidulated juice.

He suggests the following means for preventing such solvent action, and for getting rid of any metal already in solution.

1. Acidulation of the liquid in the diffusion batteries must be avoided; and the consequent slower extraction made good by heating the liquid in the earlier vessels.

2. The extracted juice should be slightly acidulated and heated. The albuminoids which coagulate at 53°—73° C., fix a considerable proportion of the dissolved metal derived from the diffusion apparatus.

3. Subsequently the juice should be aerated, the most economical plan being to spray it into a vessel through which air is being forced by a fan.—H. T. P.

Molasses, Distilleries utilising; Methods for Measuring the Consumption of. J. Steiner. Zeits. f. Spiritusind. 1899, **22**, [31], 277—278.

An accurate determination of the daily consumption of molasses being an indication of value, as a check on the efficiency of the plant and process, the author describes two methods for the purpose, in use in Austro-Hungarian distilleries.

According to one plan, the molasses are transferred from the stock reservoir to smaller gauged tanks, situated for convenience near and over the fermenting vessels, into which it is let down as required. In these tanks, the "dip" is ascertained before and after each filling; and at the same time a 2—3 litre sample of the molasses withdrawn. The samples thus collected during 24 hours are mixed to form an average sample, of which the density is determined. The product of density and volume (from the several "dips") of molasses is the weight required.

Another method said to be more accurate and convenient in practice requires the following data:—

1. The several volumes and specific gravities of the diluted molasses before fermentation. To this end the respective vessels must be gauged.

2. Units of comparison, *i.e.*, the volume of diluted sugar solution yielded by a known weight of molasses at each of the specific gravities employed on the large scale; to be determined by experiment with lots of, say, 1 kilo. of the "average" sample of molasses. The weight of molasses is then found by dividing the various volumes under 1 by the corresponding unit volumes under 2.—H. T. P.

PATENTS.

Distillery Refuse, Destruction of. D. B. Cumming, Liverpool, and J. H. Fullarton, Greenock. Eng. Pat. 16,767, Aug. 3, 1898.

The inventors claim the process for the destruction of distillery liquid refuse, by the evaporation of such liquors in evaporators or small boilers disposed in the flues of the distillery plant which convey the waste hot gases to the chimney stalk. The liquid is freed from solid matter by treatment in a centrifugal separator, it is then supplied to the small boilers in the main flues and the concentrated syrupy liquor is periodically blown off from these boilers into the chimney.—J. F. B.

Beer, Method of and Means for Racking. E. Kersten, Richmond, U.S.A. Eng. Pat. 26,885, Dec. 20, 1898.

The method consists in establishing a downwardly flowing body of clear liquid through a body of turbid liquid until the level of the turbid liquid is reached, the body of the clear liquid being at the sides in communication with the turbid liquid and the pressure of the former maintaining its free outflow without mixing with the latter. The device for racking beer consists of a discharge outlet vessel arranged in the body of the cask having two inflows open all the time at different levels, the upper opening being in the clear liquid and the lower opening being within the layer of turbid liquid and chips. When all the fine beer has run off through the upper opening, the turbid beer below then comes through the lower opening into a separate cask.—J. F. B.

Brewers' and Distillers' Wort. F. Thatcher, West Drayton. Eng. Pat. 16,443, Aug. 12, 1899.

The inventor claims the manufacture of a liquid to be used as brewers' or distillers' wort or as an addition thereto by diluting the waste yeast with water, adding a proportion of a suitable acid, infusing and efficiently boiling the solution, neutralising and filtering or allowing it to settle. This is best used as a mashing or sparging liquor.—J. F. B.

Distillery Effluents, Disposal of. J. H. Fullarton, Greenock, and D. B. Cumming, Liverpool. Eng. Pat. 22,058, Oct. 20, 1898.

The claim provides for the disposal of distillery effluents or liquid refuse by the heat of the waste gases in the flues or bottom of the smoke stack of a distillery, by discharging it in a sprayed or atomised state into it, whereby the heat of such waste gases vaporises the liquid and in the form of vapour it becomes intermixed with and carried away by the same.—J. F. B.

Erratum.—This Journal, 1899, 933, col. 1, line 15 from bottom:—For "Nitrates" read "Nitrites."

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Butter-fat, Contribution to the Study of. A. van Engelen and P. Wauters. Bull. Assoc. Belge des Chim. **13**, [6], 282—290.

The authors consider that butters of abnormal character are not peculiar to any district or time of year, neither is any influence exerted in this connection by the period of lactation; but the causes are to be sought in physiological conditions at present undetermined. For example, under a daily regimen including 2 kilos. of cotton-seed cake (240—280 grms. of oil), the butter examined contained 86·9 grms. of fixed, and 32·4 grms. of volatile acids, whilst when the quantity of cake was reduced to 1 kilo. (120—140 grms. of oil), he butter contained 89·7 grms. of fixed acids and 23·3 rms. of volatile acids; and though it seemed, from the xamination of the butter from an entire dairy, that the eriod of lactation influenced the composition, the butter rom four cows three months after calving was found to be lentical with that from another set of four examined 0 months after calving.—C. S.

Walnut Oil-Cake: Its Composition, Application, and Value as Food Material. B. Fallot. J. d'agric. prat. 1898, 628; Chem. Centr. 1899, **2**, [13], 629.

ʃHE composition of walnut oil-cake is given as follows:—

—	Cold-pressed.	Warm-pressed (Analyses of Eight Samples).		
	Per Cent.	Per Cent.		Per Cent.
Water	9·40	4·11—15·04	average	11·40
Protein substances	31·79	29·29—44·87	„	37·77
Fatty matter	27·17	9·26—20·06	„	13·68
Extract, free from nitrogen.	20·61	21·96—33·62	„	27·75
Crude fibre.	6·83	3·11— 9·01	„	4·56
Ash	4·20	4·36— 5·27	„	4·77
P_2O_5	1·77	0·40 – 2·40	„	1·71
Potash	0·87	1·27— 1·59	„	1·39

The author states that walnut oil-cake may be reckoned as a strong, concentrated fodder material, if one accepts, under this designation, those fodder materials which contain more than 12 per cent. of protein and less than 20 per cent. of crude fibre.—A. S.

Proteoses and Peptones, Solubility of, in Alcohol. J. Effront. Bull. Soc. Chim. 1899, **21**, [14], 676—680.

ALTHOUGH alcohol has been variously recommended as a means for separating the products of peptonisation, the published data on the subject are contradictory and incomplete. The author's experiments, made with a view to evolve a quantitative method, show that the precipitation of proteoses by alcohol is apparently complete, and the separation from peptones satisfactory, provided the operation be effected in a *neutral* solution. In presence of traces of acid, such as often are found in commercial peptone, precipitation is incomplete, and may be altogether prevented by the addition of a small proportion of mineral acid. A method for the separation of proteoses and peptones is described in a second paper. (*See under* XXIII., *page* 1059.)—H. T. P.

Albuminoids, The Reversible Liquefaction of. Tsvett. Comptes Rend. **129**, [15], 551—552.

MANY organic substances, such as phenol, the dihydroxybenzenes, chloral hydrate, &c., act like acids and alkalis in facilitating the swelling and ultimate solution of albuminoids. An aqueous solution (80 per cent.) of resorcinol dissolves 3 or 4 per cent. of gelatin; if more gelatin be added, it liquefies completely, and the whole separates into two layers—the upper, a solution of gelatin in aqueous resorcinol; the lower, a solution of aqueous resorcinol in gelatin. The coefficients of mutual solubility vary with the concentration and the temperature; when they are the reciprocals of one another, we have what the author calls the critical state. The solution of the albuminoid in the aqueous [resorcinol is a purely physical action, for the dissolved substance can be recovered by dialysis or by precipitation by water. Caseïn, hæmoglobin, peptones, and protoplasmic albuminoids are all liquefiable in this manner; myosin, egg albumin, and legumin are not.—J. T. D.

Syntonin, Albumoses, and Peptones; Estimation of. J. Effront. Bull. Soc. Chim. 1899, **21**, [14], 680.

See under XXIII., *page* 1059.

Sawdust in Flour and Bran, Detection of. G. A. Le Roy. Ann. Chim. anal. appl. **4**, 221; Chem. Centr. 1899, **2**, [8], 454.

See under XXIII., *page* 1055.

PATENTS.

Gelatinous Matter and Cellulose, Extraction and Utilisation of, from Marine Plants, and the Treatment of the Liquors Obtained. S. Pitt, Sutton. From G. Laureau, Son, and Co., Quiberon, Morbihan, France. Eng. Pat. 20,357, Sept. 26, 1898.

MARINE plants, such as kelp, fucus, algæ, and lichens, are treated with lime-water or chloride of lime, and subsequently with alkalis, in order to separate the gelatinous matter, which is suitable as an article of food, from the cellulose and from inorganic substances ("saline and iodine products").—S. K.

Sterilising and Blanching Cereals and Alimentary Leguminous Substances, Process for, and the Meal Produced therefrom. E. Frichot, Dreux, France. Eng. Pat. 21,971, Oct. 18, 1898.

WHEAT and other cereals are submitted in layers to the action of oxygen or ozone. In the case of flour it is preferable to employ dry ozonised air, but in other cases ozonated water may be used.—W. P. S.

Tea Products and the Use thereof. J. Roger, London. Eng. Pat. 22,590, Oct. 27, 1898.

CRUSHED and disintegrated tea leaves are thoroughly extracted with hot water. The extract is distilled *in vacuo.* The first portion of the distillate contains essential oils, which are separated by extraction with ether. On continuing the distillation, a thick semi-fluid liquid is left in the retort, consisting, of course, of extract of tea. This is mixed with the above obtained essential oils and used as a beverage. The essential oils may also be used for flavouring other liquids, such as soda-water and alimentary preparations.—W. P. S.

Butter for Purposes of Conservation and Subsequent Restoration to the Fresh Condition, Process and Apparatus for Treating. M. Julien, Paris. Eng. Pat. 23,637, Nov. 9, 1898.

THE process claimed consists essentially of two operations. In the first the butter is melted at a temperature of about 40° C. to allow the water, &c., to settle out, the clear fat being then run off into suitable casks for preservation and transport. The second operation consists in restoring this preserved butter-fat to its original condition when required for use. To effect this, the butter is again melted and mixed with milk, and the mixture is pumped into a specially constructed cylinder. When a suitable pressure has been attained in the cylinder, a valve is opened automatically and the mixture of butter-fat and milk escapes through minute openings, which are so arranged that the jets of liquid impact one against another. A perfect and intimate mixture is thus made of the milk and butter fat, which is then worked up as usual.—W. P. S.

Milk, Milk Products, and other Fatty, Solid, or Liquid Matters; Process for Analysing, and Apparatus therefor. V. Durant, Brussels. Eng. Pat. 14,029, July 7, 1899.

See under XXIII., *page* 1061.

Milk, Improved Process for Producing Condensed. A. Gurber, Würzburg, Bavaria. Eng. Pat. 17,145, Aug. 24, 1899.

IN this process for producing condensed milk, skimmed milk is put in a centrifugal separator, and there alternately caused to freeze and thaw. During the successive processes of congealing and thawing, the superfluous moisture is eliminated, and the milk is concentrated.—W. P. S.

Eggs, Fruit, and Eatables in General; Method of Preserving. A. M. Clark, London. From F. Dippel, Heidelberg, Germany. Eng. Pat. 25,401, Dec. 1, 1898.

ACCORDING to the claims of this patent, eggs are dipped in a pickling solution of brine or other preservative, and then placed in a tightly-fitting caoutchouc bag or covering, which is then hermetically closed. Fruit may be placed in the

caoutchouc coverings direct, but all hollow parts on the fruit should be filled up with paraffin wax, so that the covering comes into close contact with the article.
—W. P. S.

Eggs, Process for Treating. D. D. Wilson and J. A. Wilson, Seaforth, Ontario, Canada. Eng. Pat. 15,461, July 27, 1899.

The patentees cover the fluid (lime water) in which the eggs are pickled with a layer of oil. On removing the eggs from the preserving vats, they are first well washed with clean water, then immersed in a solution of hydrochloric, sulphuric, or acetic acid, and again thoroughly rinsed with water.—W. P. S.

Blood, Food from. M. Dietrich, Berlin. Eng. Pat. 27,246, Dec. 24, 1898.

Fresh blood is treated with burnt lime and phosphate of lime, or with Thomas-slag. The jelly which separates out is then mixed with grass, hay, or bran, &c. (whereby the free lime in solution is neutralised), and finally dried *in vacuo* and pulverised.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Nitrites in Water, Comparison of Methods for Detecting. L. Goblet. Bull. Assoc. Belge des Chim. **13**, [7], 345—347.

The methods examined by the author were those of Griess (metadiamidobenzene) and Riegler (sodium naphthionate and β-naphthol), and he finds that whilst the former reagent ceases to give accurate indications below 0·1 mgrm. of potassium nitrite in 100 c.c. Riegler's reagent is capable of detecting 0·005 mgrm. of nitrite in 10 c.c. of water.
—C. S.

Sewage Clarification at Frankfort, Investigation of the Sludge obtained in the. Bechhold. Zeits. angew. Chem. 1899, [36], 849—854.

The sewage from Frankfort-on-the-Main and Sachsenhausen is conducted into a common basin, and after the removal of its coarser constituents, passes into a chamber, where it is mixed with a solution of alum and decomposed by the addition of milk of lime. Only a small quantity of the lime reacts with the alum, the bulk being converted into calcium carbonate by the decomposition products in the sewage. The liquid now passes by a common gallery into four clarification chambers, which it leaves at a mean velocity of from 6 to 8 mm. per second, during which the suspended precipitate settles to the bottom, whilst the clarified sewage flows into the Main.

From the author's examination of the precipitated sludge, it appears that the latter contains a readily saponifiable mixture of fats, free fatty acids, and compounds of fatty acids and bases. Old deposited sludge from the clarification chambers was found to contain 2·27 per cent. of fat, of which 27·8 per cent. consisted of fatty acids in combination with bases. The fresh precipitate contained from 3·38 to 26·79 per cent. of fat (including fatty acids), the amount varying with the place from which the sample was taken, and the time of taking. The scum floating on the surface of the water in the chambers contained up to 80·29 per cent. of fat, including combined fatty acids. Most of the fat contained in the sewage is deposited between the middle and the end of the clarification chambers, whilst the quantity settling in the gallery is relatively small.

Basing his results on the examination of samples taken from May to July, 1893, the author calculates that in that year some 698,476 kilos. of fat were removed from the Frankfort sewage—an amount which corresponds to about 3·58 kilos. per year for each head of the population.

The fatty acids, combined with the bases, require an addition of a considerable quantity of acid (35 to 50 per cent.) for their complete liberation.

Iron is present in the sludge in the lower state of oxidation.

Within a few months the fat in the sludge is decomposed, with the exception of a small fraction, by micro-organisms, being probably, in the author's opinion, oxidised to carbon dioxide. This destructive process takes place more completely in the dark, and at summer temperatures, than in daylight and in winter.—C. A. M.

Cyanide Poisoning. Journ. of the Chem. and Metall. Soc. of S. Africa. 1899, **2**, 168—169.

In correspondence on this subject (this Journal, 1899, 616) L. Carter bears witness that hydrogen peroxide is an antidote to potassium cyanide but suggests that "ozonic ether" should be tried on account of its greater stability. There is another danger in cyanide works which should not be overlooked, *viz.* poisoning by arseniuretted hydrogen from the arsenic in the zinc.

J. Loevy writes that iron and cobalt salts taken to produce non-poisonous cyanide compounds, are less liable to be effective than hydrogen peroxide, which acts after cyanide has been decomposed and the hydrocyanic acid has got into the blood, by preventing the formation of cyanide-hæmoglobin. Complete sets of apparatus are now available, containing the peroxide, ready for use, in hermetically sealed sterilised tubes.—A. W.

Nitric Acid in Water, Determination of. Russwurm. Pharm. Centr.-H. **40**, 516; Chem. Centr. 1899, **2**, [12], 593.

See under XXIII., *page* 1052.

Tanneries, Anthrax in. Chem. and Druggist, Oct. 28, 712.

See under XIV., *page* 1035.

Distillery Effluents, Disposal of. J. H. Fullarton, Greenock, and D. B. Cumming, Liverpool. Eng. Pat. 22,058, Oct. 20, 1898.

See under XVII., *page* 1044.

PATENTS.

Filters or Bacteria Beds for Sewage or Sewage Effluent, or Receptacles which are Filled and Emptied Alternately. D. Cameron, F. J. Commin, and A. J. Martin, Exeter. Eng. Pat. 19,697, Sept. 16, 1898.

Improvements in the details of apparatus described in specification numbered 27,349 of 1897 and 5671 of 1898 (this Journal, 1898, p. 905, and 1899, p. 512).

The actuating buckets, by which the outlet valves of two filter tanks are alternately raised and lowered, are connected by one fixed siphon, by which liquid is passed from the full bucket to the empty one, causing the latter to overbalance and close its valve, opening at the same time the valve connected to the other bucket. Means are also described for causing a gradual instead of a sudden discharge of the contents of a filter-bed, also for causing valves to open gradually instead of suddenly and for bringing them to rest without shock. The liquid discharged from a filter-bed is aerated either by inserting perforated air-pipes in the shoot, through which air is drawn by injector action, or by causing the effluent to escape through a number of holes, and be thus broken up into jets and spray.—L. A.

Water Softening and Purifying Apparatus. W. J. Wright, London. Eng. Pat. 21,288, Oct. 10, 1898.

The apparatus, which works on the continuous-flow principle, consists of a large settling-tank furnished with a series of inclined plates which cause the water to flow upwards in a zigzag course, a smaller mixing tank which is a partitioned-off portion of the large tank, and two reagent tanks for lime water and caustic soda solution. The main water supply falls into the mixing tank through a rocking trough, fixed on a shaft which actuates (1) a mixer in the lime tank, and (2) a pump in the caustic soda tank. A portion of the water is led through the lime tank. The hard water and lime water flowing in suitably proportioned streams, into the mixing tank, and mingling there with the caustic soda which is automatically pumped in, react, the greater part of the precipitate is deposited on the sloping plates of the settling tank, and clear water flows away through a filter placed at the top.—L. A.

Softening and Clarifying Water, Apparatus for. W. J. Baker, Scarborough. Eng. Pat. 21,777, Oct. 17, 1898.

This invention relates to improvements in apparatus described in Eng. Pats. 91 of 1895 and 15,384 of 1897 (this Journal, 1898, 687). The settling tank is divided into three parts. The first two parts or divisions are fitted with pivoted shelves, through perforations in which the turbid water rises, depositing its precipitate on the shelves which are placed horizontally. When it is desired to remove the precipitate, the shelves are tilted by raising a chain attached to one side, and the mud slides off and falls to the bottom of the tank. A filter is fixed between the second and third divisions of the tank, the latter of which is for the storage of softened water. The surface of the water in the two first divisions is cleared of scum by stopping the outflow from the tank and allowing the level to rise until the water overflows the lip of a skimming trough or gutter. Jets of clean water are then squirted on to the surface of the water from a perforated pipe fixed across the tank.—L. A.

Sewage and other Foul Liquids, Tipping Troughs for Distributing, on Filter Beds. W. M. Ducat, London. Eng. Pat. 24,666, Nov. 22, 1898.

The trough claimed consists "of two trough-like members symmetrically arranged at opposite sides of a common longitudinal vertical plane, the trough being so mounted that its axis of oscillation is in such relation to its centre of gravity that the weight of each member of the trough alternately will preponderate when filled, and the trough will be automatically oscillated from side to side in such manner as to discharge the whole contents at each oscillation."—L. A.

Waste Water or Sewage, Process for Purifying by Precipitation. W. P. Thompson, Liverpool. From C. G. Gsell, Berlin. Eng. Pat. 25,000, Nov. 26, 1898.

The process claimed consists "in adding to the mud obtained by a preceding precipitation of waste water, as much sulphuric acid as is required to convert the bases contained in the mud (alumina, iron oxide, iron protoxide) into sulphates, and precipitating with this product a fresh quantity of waste water, the first precipitation for obtaining the first mud being effected in any convenient manner."
—L. A.

(C.)—DISINFECTANTS.

Mixtures of Fungicides containing Copper with Soap Lyes, Examination of the most Suitable Forms of. M. Hollrung. Landw. Jahrbb. **28**, 593—616; Chem. Centr. 1899, **2**, [13], 628.

The author gives as suitable for the destruction of fungi and insects, curd-, soft-, and resin-soaps in combination with an aqueous copper-lime mixture, cuprammonium solution, copper carbonate mixture, and ammoniacal cuprammonium solution, and "petroleum soap" mixed with copper-lime. The greatest durability and the most favourable mechanical condition were observed with the following mixtures:—Copper oxide infusion, 1 per cent.; copper sulphate, 0·5 per cent.; quick lime with curd soap, 1—3 per cent.; soft soap, 1—3 per cent.; rosin soap (colophony, 2; soda crystals, 1; and water 8 parts), 7—9 per cent.; petroleum soap (petroleum, 2 litres; curd soap, 125 grms.; water, 1 litre), 2·6 per cent. Ammoniacal copper sulphate solution (copper sulphate, 500 grms.; ammonia, 17° B.; 750 c.c. to 100 litres of water) with curd soap 2 and 3 per cent.; soft soap, 3 per cent.; rosin soap, 3 per cent. Copper carbonate mixture with curd soap, 2 and 3 per cent.; soft soap, 2 and 3 per cent.; rosin soap, 1, 2, and 3 per cent. Burgundy infusion with rosin soap, 2—4 per cent. Ammoniacal copper carbonate mixture with curd soap, 2 and 3 per cent.; rosin soap, 2—6 per cent. A very good and uniform emulsion, giving no deposit on standing, is produced with 3 per cent. of curd soap.

With regard to the behaviour of these emulsions towards plants, the presence of up to 3 per cent. of curd or soft soap, 9 per cent of rosin soap, or 6 per cent. of petroleum soap, exerts no injurious action even in the case of plants with delicate foliage. The best distribution is attained with the infusions containing resin and petroleum soaps, and the greatest fixing power with the mixtures containing rosin soap, particularly the copper oxide mixture with 9 per cent. of rosin soap, and the ammoniacal copper carbonate mixture with 6 per cent.—A. S.

Formaldehyde, Detection and Estimation of. C. Neuberg. Ber. 1899, **32**, [11], 1961.

See under XXIII., *page* 1059.

PATENTS.

Sterilising Liquids by Means of Ozone, Apparatus for. Baron H. Tindal, Amsterdam. Eng. Pat. 24,542, Nov. 21, 1898.

The apparatus consists of a tall cylindrical vessel divided into a series of chambers by transverse partitions, which are finely perforated. Each chamber is connected by outside pipes with the chambers immediately above and below it. The ozonised oxygen is forced into the lowest chamber, and passes up through the perforations; the liquid to be sterilised is passed into the topmost chamber and descends from chamber to chamber through the lateral pipes. (See also Eng. Pat. 24,543, under XI.A., p. 1029).—L. A.

Antiseptics and Deodorisers. A. Zimmermann, London. Eng. Pat. 19,326, Sept. 10, 1898.

Paraformaldehyde is mixed with a hygroscopic salt, such as calcium chloride, and infusorial earth or sawdust, a suitable mixture containing 1 per cent. of paraformaldehyde with 12 per cent. of calcium chloride, 12 per cent. of infusorial earth, 63 per cent. of kieserite, and 12 per cent. of sawdust. When this powder is applied to organic refuse, the moisture supplied by the hygroscopic salt depolymerises the paraformaldehyde into active formaldehyde, and thus prevents putrefaction from taking place.
—L. A.

Producing Gases and Vapours for Fumigating and other Purposes, and Apparatus therefor. J. Marie-Louise Messerli, Paris. Eng. Pat. 25,139, Nov. 29, 1898.

The process claimed consists in placing the volatile liquid or solid disinfectant or substance, such as camphor, menthol, phenol, &c., within an incombustible chamber having an outlet sealed with wax. The heat necessary for the evaporation or volatilisation of the substance is generated by setting fire to a combustible coating applied to the exterior of the chamber.—L. A.

Disinfecting and Deodorising Device. C. E. Blake, Minneapolis, Minnesota, U.S.A. Eng. Pat. 17,475, Aug. 29, 1899.

The device consists of a ball, bulb, or shell of volatile substance, such as naphthalene, enclosing a porous chamber filled with a suitable disinfecting liquid, which evaporates through, and with the volatile substance. The liquid is preferably composed of "4 parts of formalin and 3 parts each of carbolic acid, menthol, thymol, and eucalyptol."
—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

Paper, Cement Sacks as Raw Material for. Papier Zeit. 1899, **24**, [81], 3162.

These sacks make a good raw material for coarse common packing papers. They should be well shaken and sorted by hand into three classes according to the quantity of cement adhering to them. Paper containing cement sacks should not be finished on any machinery which might be damaged by the grit, only changeable strainers should be used, and the pulping should be done in an old partially worn-out "hollander."—J. F. B.

Paper Pulp, Steam Ejectors for Raising. Papier Zeit., 1899, **24**, [81], 3162.

The heat of the steam ejector often has an influence on the pulp, for instance, the shade of the paper may be altered by the changes brought about by the action of heat on an aniline dye, or pulp coloured sulphur-yellow with lead chromate may be changed to an orange tint. The sizing may be damaged and the paper injured by the sudden application of heat and resin stains may be caused. Another defect of the steam ejector is the violent foaming of the pulp which accompanies its use, since unnecessary contact with air is undesirable at this stage. On the other hand steam ejectors exert a favourable effect when the pulp is slimy, causing a better felting and preventing stickiness in pressing. The pulp gets warm during the mechanical working in the "hollander," up to 30° C., and many factories also heat it with steam during this process, even as high as 80° C. By this means the fibres are softened, and a saving of power and time is effected.—J. F. B.

Paper Making, Problems in. **J. G. F. Lowson.**
See under Scottish Section, *page* 996.

Highly Glazed Surface Papers. R. Irvine.
See under Scottish Section, *page* 997.

Oxycellulose, Investigations on. O. v. Faber and B. Tollens. Ber. 1899, **32**, [14], 2589.
See under V., *page* 1014.

Discharge Valve for Hollanders. **J. M. Voith.** Ger. Pat. 118,874, Papier Zeit. 1899, **24**, [82], 3202.

Figures 1 and 2 show vertical cross sections of the open valve from two points of view. The flap A, covers a rectangular opening, extending across the bottom of the trough of the hollander D. This flap is raised by moving the lever B, on the hinges C, which are connected with the flap by the curved arms E. By this means the finished pulp can be swept out and discharged in a much shorter time than was possible with the old plug valves.—J. F. B.

Fig. 1.

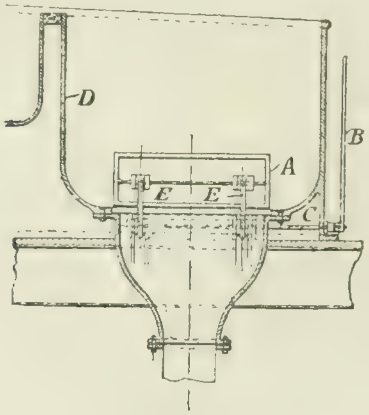
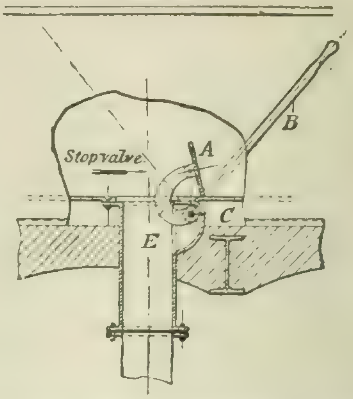


Fig. 2.



XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Correct Melting Points [Pharm. Chem. Substances], Determination of. Thos. Tyrer and A. Levy. Read before the Brit. Pharm. Conference, July 1899.

The researches of Reissert (Ber. 1890, **23**, [2], 2239) and Landolt (Zeits. physik. Chem. **4**, 352), indicate that in melting point determinations, accurately graduated thermometers must be used; that not only should such thermometers be frequently corrected, but that these corrections should be especially applied to the exposed portion of the mercurial column. Differences amounting to several tenths of a degree may be obtained by using capillary tubes of different bores. With regard to the correction for the exposed mercurial column, reference is made to Rimbach (Ber. 1889, **22**, 3075), Kopp (Ann. Chem. Pharm. **94**, 262); Handwörterbuch d. Chem. **7**, 368; J. Chem. Soc. **37**, 160; and Biedermann's Chem. Kalender.

The authors have determined the melting points of sulphonal, acetanilide, phenacetine, and phenazone (antipyrin), by five different methods.

——	Sulphonal.	Acetanilide.	Phenacetine.	Phenazone (Antipyrin).
	°	°	°	°
B.P. melting point	125·5	113·5	135·0	113·0
Melting point of commercial substance	125·07	111·36	133·86	109·16
" " dried substance	125·24	112·42	134·31	110·04
" " purified* substance	125·26	113·49	134·92	112·88

* Purified with consecutive crystallisations showed constant melting points.

(1.) The B.P. method (B.P. 1898, 436).

(2.) Graebe's method — heating the substance in a capillary tube attached to a thermometer in a test tube containing sulphuric acid.

(3.) Landolt's method (*loc. cit.*) — the substance is heated in a narrow test tube placed in a wider tube, the whole being surrounded by a glass cylinder open at both ends. The method gives accurate results, which agree fairly well with those obtained by Graebe's method, if the temperature be taken at the beginning and completion of melting, and at the re-solidification point of the substance; the only objection is the comparatively large amount of substance required.

(4.) Piccard's method (Ber. 1875, **8**, 687)—the substance is heated in a capillary tube on the end of which is blown a bulb at an acute angle. When the substance melts, the expansion of the air in the bulb forces it up the capillary, so that the point is easily seen. The method tends to give high results.

(5.) A modification of Loewe's method (Zeits. anal. Chem. **11**, 211), and Chrystomanos' (this Journal 1890, 894)—the substance is heated whilst preventing contact between a platinum wire and mercury. When the substance melts, the platinum comes in contact with the mercury and completes a circuit, in which is included an electric bell.

In the experiments, centigrade thermometers were used, graduated from 0·5° to 360° in single degrees, which were compared with two standard thermometers, one graduated from $-10°$ to 50° in tenths of a degree, and the other from

– 10° to 100° in fifths of a degree. An additional thermometer was used to take the mean temperature of the exposed columns.

Care should be taken that the thickness of the capillary tube walls be as nearly as possible the same as the thickness of the walls of the bulb of the thermometer.

In the table on the previous page the average melting points, after correction, by the five methods are given, together with the B.P. constants.

The results show that the B.P. factors are too high for commercial acetanilide, phenacetin, and phenazone (antipyrin), the official factors being apparently based on the chemically pure or water-free products, which it would be exceedingly expensive, if not difficult, to supply. Commercial phenazone meets the Dutch and Japanese standards, though not the British and German.—A. S.

Cream of Tartar, New Method of Producing Commercial. — Gladysz. Rev. Prod. Chim. **2,** [17], 258.

A COLD-SATURATED hydrochloric acid solution of a mixture of calcium tartrate and potassium bitartrate is treated with sodium bisulphite, whereupon a fine granular precipitate of potassium bitartrate separates out in a short time. The same result is obtained by treating a similar solution with calcium hydroxide, in quantity equivalent to the potassium present, and then passing a current of sulphur dioxide through the liquid until saturated. Further, the cold-saturated sulphurous solution of calcium tartrate treated with an equivalent quantity of potassium chloride, and agitated without heat, giving a similar precipitate. The product, when drained, washed with a saturated solution of bitartrate, and dried in the oven, forms a white crystalline powder, 98—99 per cent. pure.—C. S.

Catha Edulis [*Cathine*]. A. Beitter. 71st Meeting of the Soc. of German Scientists and Physicians, Munich, 1899; through Chem. Zeit. 1899, **23,** [79], 832.

AN examination of the leaves of *Catha edulis* [Ar. "Kât"] showed that the principal constituents are:—A physiologically active alkaloid, cathine, occurring in rhombic crystals giving well crystallised sulphate, hydrobromide, and salicylate; considerable quantities of caoutchouc; a tannic acid closely resembling the tannin of tea leaves; mannite; small quantities of an ethereal oil, containing chiefly oxygenated components, and a fatty oil which is present in catha seeds to the extent of about 50 per cent.
—J. F. B.

Pseudocinchonine [*Cinchotine*] *and the Behaviour of Cinchonine Hydrochloride.* F. v. Arlt. Monatsh. für Chem. **20,** [5], 425—449.

HESSE showed that, together with addition products obtained by the action of hydrochloric acid on cinchonine, other bases isomeric with cinchonine are simultaneously formed, one of which he termed pseudocinchonine. The author finds that body is actually cinchotine itself, and he also shows that on removing the hydrochloric acid from cinchonine hydrochloride with silver nitrate or caustic potash, the same bases are obtained, but in different proportions.
—T. A. L.

Essential Oils and Glucosides of some Cresses. J. Gadamer. Ber. 1899, **32,** [13], 2335—2341.

THE author has shown (Arch. Pharm. 1897, 577) that the essential oil of horse-radish (*cochlearia armoracia*) is identical with allyl mustard oil, and is produced by the decomposition of sinigrin by myrosine. A. W. Hofmann had found that the essential oils of the cresses *tropæolum majus*, *nasturtium officinale*, and *lepidium sativum*, were not thiocyanates but nitriles (Ber. **7**, 518, 520, 1293).

The essential oils of *tropæolum majus* (nasturtium) and *lepidium sativum* (garden-cress) are identical, and consist of benzyl mustard oil. They were obtained by distilling finely divided fresh herbs with steam, salting out, and extracting with ether. Varying quantities of benzyl cyanide accompany the oil; the amount of cyanide depends on the state of division of the raw material—the less thoroughly divided the more cyanide is obtained. The essential oils are not contained in the plant as such, but are produced by the decomposition of a glucoside by myrosine. Glucoside and ferment are separated in the plant, and such portions of the glucoside as remain unacted upon by the ferment are decomposed on steam distillation with production of benzyl cyanide. If the plants be distilled whole, this is the principal product. The glucosides of the two plants are probably identical. They were obtained from the seeds, but could not be crystallised. The silver compound has the composition $C_8H_{13}N_3Ag_2S_2O_4$. The author names the glucoside glucotropæolin, and assigns to it the formula $KO.SO_2.O.C(S.C_6H_{11}O_5):N.CH_2.C_6H_5 + 2H_2O$.

The essential oils of *nasturtium officinale* (watercress) and *barbarea præcox* consist of phenylethyl mustard oil; they are obtained in the manner just described, and similarly contain phenylproprionitrile. The glucoside forms a silver compound, as glucotropæolin does, and its formula is—

$$C_9H_9NAg_2S_2O_4 + 2H_2O.$$

The silver compounds obtained from the glucosides are decomposed by excess of sodium thiosulphate with production of the mustard oil.—A. C. W.

Geraniol, Change of, into Terpineol of Melting Point 35° C. K. Stephan. J. prakt. Chem. 1899, **60,** [15, 16, 17], 244—254.

THE author has previously shown that linalool is readily converted by acid reagents into the terpineol melting at 35° C. (this Journal, 1898, 1070). The same product is obtained from geraniol by the action of formic acid at 15° to 20° C., and acetic acid containing 1—2 per cent. of sulphuric acid at 60°—70° C., or at the ordinary temperature. Glacial acetic acid and acetic anhydride do not produce this transformation. The mixtures of geraniol and terpineol obtained by this operation may be completely separated by heating with an equal weight of powdered phthalic anhydride and an equal volume of benzene at 80° C. for one hour. The geranylphthalic ester is converted into the sodium salt by shaking with soda, and dissolved in much water. Unaltered terpineol is then removed by three extractions with ether; the ethereal solution must be well washed, since ether dissolves small amounts of sodium geranylphthalate. After removal of ether and steam distillation with caustic soda, a mixture of terpenes and terpineol is obtained, which is separated by fractionation *in vacuo*. The aqueous solution is boiled with caustic soda, the geraniol driven over by steam and fractionated. The terpineol contained in the solution of sodium geranylphthalate cannot be driven over by steam distillation, for the salt is decomposed by this operation with the production of linalool. The same result is obtained in a completely neutral solution.

The terpin hydrate obtained from geraniol by Tiemann and Schmidt's process (shaking with 5 per cent. sulphuric acid), on boiling with dilute sulphuric acid is converted into liquid terpineol, identical with that obtained from the terpin hydrate from pinene.—A. C. W.

Santalol, Manufacture of. Haine and Co. Rev. Prod. Chim. **2,** [17], 258.

THE method adopted by the authors for obtaining this compound in a pure state consists in saponifying sandalwood oil; *e.g.*, 6 kilos. of the oil are dissolved with 600 grms. of caustic potash in 2 kilos. of 90 per cent. alcohol, and the solution, after settling, is boiled for two or three hours. The alkali and alcohol are then removed, and the product is subjected to repeated fractional distillation *in vacuo* or by means of superheated steam.

The purified santalol is colourless, boils at 303°—306° C.; the specific gravity at 15° C. is 0·979—0·980. It is soluble in 3 vols. of 70 per cent. alcohol at 20° C., and differs from commercial sandalwood oil in being perfectly limpid, and by its faint odour.—C. S.

Eudesmol [*Parent Substance of Eucalyptol*]. H. G. Smith. Chem. and Druggist, 1899, **55,** [1026], 534. From Proc. Roy. Soc. New South Wales.

THE author considers that eudesmol, the crystalline camphor isolated by R. T. Baker and himself from eucalyptus oil, should be present, at certain times of the year, in all oils which are eventually rich in eucalyptol. The formula of eudesmol, $C_{10}H_{16}O$, shows that it is isomeric with camphor, but it has the oxygen atom combined in a different manner. It is optically inactive, does not appear to be ketonic, and cannot be reduced by sodium in alcohol or by other means. It melts at 79°—80° C. when perfectly pure, but it has a tendency to form products having a lower melting point. It forms a dinitro-compound and a dibromide, but not a nitroso chloride. Camphoronic acid is formed on oxidation with dilute nitric acid, but no camphoric acid. The author shows that eucalyptol is derived directly from the high-boiling fraction of oils containing eudesmol (*E. macrorhyncha,* for instance) if the oil is kept in the crude condition for some time under ascertained conditions. Oxygen is necessary to this alteration, the oxygen atom entering the eudesmol molecule during the formation of eucalyptol.

It was also found that the oils from certain groups of eucalypts are dextro-rotatory when they contain the maximum proportion of eucalyptol, and that they do not, at that time, contain phellandrene, although the latter may be present at certain times of the year.—A. S.

Oil and Terpene from Aralia Nudicaulis. W. C. Alpers. Amer. J. Pharm. **71**, 370—378; Chem. Centr. 1899, **2**, [13], 623.

The fresh root of *Aralia nudicaulis* contained 40—60 per cent. of water, the dried drug containing, on the average, 5·53 per cent. of ash, about 1·38 of which consisted of the chlorides and sulphates of sodium and potassium. The dark red fatty oil obtained by extraction had a specific gravity of 0·921 at 20° C.; solidified at 3° C.; acid number, 7·3; saponification number, 192; iodine number, 106; was soluble in petroleum spirit, benzene, ether, and chloroform, slightly soluble in absolute alcohol, and insoluble in water; and consisted essentially of triolein, $C_3H_5(C_{18}H_{33}O_2)_3$.

The essential oil obtained by steam-distillation of the finely powdered aralia (yield about 0·12 per cent.) had a pleasant, aromatic odour, and consisted, for the most part, of a sesquiterpene, $C_{15}H_{14}$, called by the author *aralien*, with specific gravity, at 20° C., 0·921; boiling point, 270° C.; $[\alpha]_D = -7°$ to $-8°$; $n_D = 1·499\ 36$. With hydrochloric acid, aralien gives an oily hydrochloride, whilst with a mixture of hydrochloric and glacial acetic acids it gives a blue-coloured compound.

Besides aralien, the essential oil contains a small quantity of a sesquiterpene alcohol and a little azulene, $C_{16}H_{26}O$, boiling point about 300° C.—A. S.

Liquorice, Commercial Extract of. E. Dowzard. Chem. and Druggist, 1899, **55**, [1027], 561.

For the valuation of Spanish juice or block juice it is necessary to determine the amount of insoluble matter, water, and ash; the amount of soluble extract—genuine extract of liquorice is completely soluble in water—being determined by deducting the percentage of insoluble matter and water from 100.

The insoluble matter is determined by dissolving 3 grms. of the powdered sample in about 200 c.c. of water (at about 45° C.), allowing the solution to stand for six hours, siphoning off the clear solution, adding more water, and repeating the process until the solution has only a light yellow colour; three washings are usually required, about six drops of ammonia being added to the last washing. The residue is transferred to a weighed filter, dried, first at 50° C., and then at 100° C., and finally weighed. In 16 samples of "Spanish juice" (solid), the amount of soluble extract varied between 59 and 83; that of insoluble matter, between 6 and 28; that of water, between 10 and 16: and that of ash, between 3·5 and 10 per cent. In 10 samples of block juice, the proportions of the constituents varied as follows: Soluble extract, 70—82; insoluble matter, 1—11; water, 14—28; and ash, 6—9 per cent.—A. S.

Liquorice Oil. H. Haensel. Pharm. Centr.-H. **40**, 533; Chem. Centr. 1899, **2**, [12], 624.

Liquorice-root contains an essential oil, which can be obtained by distillation of the roots; the yield is 0·03 per cent. from the Spanish, and 0·035 per cent. from the Russian roots. The oil from the Russian roots is dextrorotatory, that from the Spanish, lævo-rotatory. The oils react slightly acid, possibly in consequence of the presence of glycyrrhinic acid.—A. S.

Coloured Glasses, Degree of Protection against the Action of Light afforded to Drugs by Different. H. J. Möller. Arch. Pharm. og Chem. 1899, **31**, 253; through Chem. Zeit. Rep. 1899, **23**, [28], 275.

Various substances were tested, mainly photographically, by exposing them to the action of light behind different coloured glasses. From the results obtained with such substances as silver bromide, chloride, sensitive iron salts, mercury salts, chromium, gold and uranium salts, and potassium iodide, the author gives the following classification for the protective action of the coloured glasses:—

Black glass, red glass, orange glass, yellow glass, brown-yellow glass, pure-green coloured glass: Strongly protective against the chemical action of daylight.

Blueish dark-green glass, violet glass, milky glass: Protect slightly.

Blue and colourless glass: No protection.

Gold salts were protected by bluish-green glass. Chlorophyll, pyrogallol, chlorine, and sodium nitroprusside were protected by the coloured glasses in a very similar degree as the above substances.—J. F. B.

Phenolic Glucosides. H. Ryan. Proc. Chem. Soc. **15**, [213], 196.

By the action of acetochloroglucose on solutions of phenols in alcoholic potash, crystalline glucosides of the β series were obtained.

Morphine, Determination of, in Opium. C. Montemartini and D. Trasciatti. Gazz. Chim. Ital. 1899, **29**, 292; through Analyst, 1899, **24**, [10], 264.

See under XXIII., *page* 1059.

Hydrastine Hexaiodide, and the Analysis of Hydrastis Canadensis. H. M. Gordin and A. B. Prescott. J. Amer. Chem. Soc. 1899, **21**, [9], 732.

See under XXIII., *page* 1060.

Vanilla, Distinction of True Extract of, from Liquid Preparations of Vanillin. W. H. Hess. J. Amer. Chem. Soc. 1899, **21**, [9], 719.

See under XXIII., *page* 1055.

Alkaloids, New Reagent for, Detection of Opium. Mecke. Zeits. öffentl. Chem. 1899, **5**, 351; through Chem. Zeit. Rep. 1899, **23**, [28], 273.

See under XXIII., *page* 1055.

Cocaine Hydrochloride. Zimmer and Co. Pharm. Zeit. 1899, **66**; through Pharm. 1899, **63**, [1527], 315.

See under XXIII., *page* 1055.

Cinnamon Water, Examination of. Duyk. Ann. Chim. anal. appl. **4**, 223; Chem. Centr. 1899, **2**, [8], 455.

See under XXIII., *page* 1060.

Lupuline, Composition of Commercial. R. W. Moore.

See under New York Section, *page* 987.

PATENTS.

"*Artificial Camphor*" *from Hydrocarbon Oils of the Terpene Series, Manufacture of.* J. E. T. Woods, Brixton, Surrey. Eng. Pat. 13,688, June 20, 1898.

The processes claimed consist in oxidising camphene, obtained from pinene hydrochloride, by heating it with an alkali permanganate, chromate, bichromate, ferrate or chlorate, and dilute sulphuric acid; in oxidising American turpentine to "camphoric acid" by air and steam at 230° F. and reducing to "camphor" by nascent hydrogen or by heating with camphene; and in converting turpentine or terpene oils into "camphor" by agitation with strong sulphuric acid.—A. C. W.

Piperidine and Dihydroquinoline, Preparation of. W. Pip. Darmstadt, Germany. Eng. Pat. 21,471, Oct. 12, 1898.

In the preparation of piperidine and dihydroquinoline from pyridine and quinoline by electrolytic reduction, the patentee claims the use of a considerable excess of acid and of lead electrodes. Carbon may be substituted for lead, and mercury or silver may be used for cathodes. Also the employment of acids and materials (diaphragms, &c.) as free as possible from metallic compounds, is claimed.—A. C. W.

Methyl Morphine (Codeïne) and Ethyl Morphine, Process for Producing. E. Kauder, Darmstadt, Germany. Eng. Pat. 26,639, Dec. 16, 1898.

In the process claimed in Eng. Pat. 18,050, 1898 (this Journal, 1899, 856) methyl and ethyl nitrate may be advantageously employed instead of phosphoric acid esters.
—A. C. W.

Compounds [Lithium Quinate] for the Treatment of Gout and Analogous Diseases. G. W. Johnson, London. From Vereinigte Chininfabriken Zimmer and Co., Frankfort on Maine, Germany. Eng. Pat. 27,333, Dec. 27, 1898.

The essential constituent of the mixtures claimed, is lithium quinate, with the quinic acid in excess, or with "magnesia or equivalent base." The preparation may take the form of an effervescent water.—A. C. W.

[*Methyl Anthranilate*] *Aromatic Ether, Manufacture of.* C. D. Abel, London. From Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany. Eng. Pat. 75, Jan. 2, 1899; see also this Journal, 1899, 856.

The following processes are claimed for the manufacture of methyl anthranilate. Treatment of metallic anthranilates with methyl iodide; treatment of suitable metallic salts of acetylanthranilic acid with methyliodide, removal of the acetyl group by heating with mineral acids, and precipitation of the ester by alkalis; heating acetylanthranilic acid with methyl alcohol and a mineral acid, and decomposition of the salt formed by an alkali; reduction of *o*-nitro-benzoic methyl ester.—A. C. W.

(3^1) - *Hydroxycaffeïne, Preparation of Derivatives of.* G. W. Johnson, London. From C. F. Boehringer and Soehne, Waldhof, Mannheim, Germany. Eng. Pat. 16,231, Aug. 9, 1899.

According to Eng. Pat. 26,261, 1898 (this Journal 1899, 399), 3^1.8-dichlorocaffeïne is converted into chloroparaxanthine on warming with water, in this reaction 3^1-hydroxy-8-chlorocaffeïne is an intermediate product. Derivatives of this substance are obtained by acting on 3^1.8-dichlorocaffeïne with alcohols, these 3^1-alkoxy-8-chlorocaffeïnes are claimed as a new series of compounds, together with the process for their production. The manufacture of derivatives of 3^1-hydroxycaffeïne by reducing 3^1-alkoxy-8-chlorocaffeïne or treating it with alcoholic alkali or with ammonia is also claimed.—A. C. W.

XXII.—EXPLOSIVES, MATCHES, Etc.

New Explosive and Detonating Material. U. Alvisi. Gaz. chim. ital. **29**, [1], 121—143 and 399—405; Chem. Centr. 1899, **2**, [8], 461, and [10], 548.

The author discusses the question of priority as to the use of ammonium perchlorate as a constituent of explosives, and then, as a result of the examination of mixtures of perchlorate and charcoal, and perchlorate, sulphur, and charcoal, with regard to their explosive and propulsive action, he concludes that such mixtures are to be recommended for certain ballistic and technical purposes. He also describes mixtures of mercury fulminate and ammonium perchlorate, suitable for special purposes.—A. S.

Persulphocyanic Acid, Use of, in Place of Phosphorus in the Manufacture of Matches. G. Craveri. Boll. Chim. Farm. **38**, 137—141, 341—345, 475—480; Chem. Centr. 1899, **2**, [8], 461.

The author states that by the use of persulphocyanic acid $H_2C_2N_2S_3$, in place of phosphorus, he believes he has solved the problem of the preparation of a safe, inflammable bright-burning, and cheap match. Persulphocyanic acid may be easily obtained from different waste residues, for instance, from Laming's material used in the purification of illuminating gas; from ammoniacal gas liquor; from residues produced in the Leblanc alkali process, &c.; and even at the present time, its price is about 70—75 per cent. lower than that of phosphorus.—A. S.

Pyrodialyte Explosives, Ordinary or Flameless. E. Turpin. Rev. Prod. Chim. **2**, [17], 259.

To render his pyrodialyte explosives (Rev. Prod. Chim. 1898, [15]) more susceptible to detonation, the author proposes an addition of from 10 to 50 per cent. of nitroglycerin, which must be thoroughly neutralised by an alkali carbonate to prevent reaction on the chlorates, &c., present. The following table shows the composition of several of these new "dynamo-pyrodialytes":—

——	A.	B.	C.	D.
Ammonium perchlorate.........	60	30	25	50
Carbon	15	10	..	10
Nitroglycerin.....................	25	15	40	35
Potassium chlorate	..	30	..	..
Ammonium picrate	..	10	..	..
Tar..............................	..	5	10	..
Potassium nitrate...............	..	..	25	..
Guncotton, collodion, &c.........	..	..	..	5

For mixing, a solution is prepared by warming, or in sulphuric ether at 56° C., or, after mixing in the warm, the operation may be completed by stirring with a little of the same ether.—C. S.

Suboxide of Phosphorus, Non-existence of the so-called. D. L. Chapman and F. A. Lidbury. Proc. Chem. Soc. **15**, [213], 186.

The authors have examined specimens of the supposed suboxide, prepared by the methods of Goldschmidt and Reinitzer, and of Michaelis and Pitsch, and have compared their physical and chemical properties with those of red phosphorus in a finely divided state, prepared by the action of sunlight on a strong solution of phosphorus in carbon bisulphide.

They demonstrate that the so-called suboxide is only an impure form of red phosphorus.

PATENTS.

Explosives. E. A. G. Street, Paris. Eng. Pat. 24,468, Nov. 19, 1898.

An explosive consisting of 80 per cent. of chlorate of potash incorporated with varying relative quantities of pitch or tar, vegetable oil, charcoal, and picric acid.
—G. W. McD.

Gunpowder and Blasting Cartridges. C. H. Curtis, C. L. W. Smith, D. J. Metcalfe, A. C. Pearcy, London, and A. F. Hargreaves, Roslin. Eng. Pat. 6523, March 25, 1899.

The patentees describe the manufacture of a gunpowder which is safe for use in dangerous mines. This explosive differs from ordinary gunpowder in the large proportion of saltpetre which it contains—not less than 83 per cent. The sulphur may be as low as 1 per cent. or totally absent, while the charcoal used should not yield more than 22—25 per cent. of volatile matter when heated in a current of hydrogen. It is claimed that the excess of saltpetre serves to reduce the temperature of the gases produced by the explosion and prevents the formation of inflammable vapour.—G. W. McD.

Explosives. F. J. W. Lindeman, Utrecht, Holland. Eng. Pat. 12,392, June 14, 1899.

Chlorate of potash, in the state of small crystals, is used as an absorbent for nitroglycerin, with the addition of nitro derivatives of benzene, and in some instances benzene itself, the relative quantities being so regulated as to produce complete oxidation of the carbon to carbonic acid. It is said that admixture with chlorate of potash renders nitroglycerin less sensitive to shock.—G. W. McD.

Matches. R. E. A. Gans, Pankow, Berlin. Eng. Pat. 25,102, Nov. 28, 1898.

An ignition material for matches consisting of a mixture of the double barium-copper salts of the polythionic series of acids, with sulphur, iron pyrites, gelatin, potassium chlorate and plaster of Paris.—G. W. McD.

Matches. A. Purgotti, Perugia, Italy. Eng. Pat. 10,865, May 24, 1899.

Cuprous sulphocyanate is substituted for phosphorus, the other ingredients consisting of barium chromate, potassium chlorate, sulphur, powdered glass and the usual agglutinating substances.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Ammonium Phosphomolybdate [Phosphoric Acid Estimation], Mechanical Precipitation of. F. Warsage. Bull. Assoc. Belge des Chim. **13**, [7], 343—345.

The inconvenience attending the precipitation by the ordinary hot method may be obviated by the following procedure:—

Five grms. of phosphate are treated in a 500 c.c. flask with 80 c.c. of nitric acid (sp. gr. 1·20), 20 c.c. of hydrochloric acid (sp. gr. 1·10), and sufficient water to make about 350 c.c.; then boiled for half an hour, made up to the mark and filtered.

The presence of a considerable quantity of ammonium nitrate being necessary to secure complete precipitation in the cold, a slight excess (about 5 c.c.) of ammonia (0·91) is added to 25 c.c. of the above solution, and after dissolving the resulting precipitate in about 10 c.c. of nitric acid (1·20), the liquid is mixed with 100 c.c. of molybdic reagent and treated in a mechanical agitator for about 20 minutes. The dense precipitate is then collected on a 9 cm. filter paper, dissolved in 15—20 c.c. of cold ammonia (0·96) and treated in the usual manner. The original solution can also be prepared in the cold by treating in the agitator for about half an hour.—C. S.

Nitric Acid, in Water, Determination of. — Russwurm. Pharm. Centr.-H. **40**, 516—517; Chem. Centr. 1899, **2**, [12], 593.

For the determination of nitric acid in water, the author makes use of the reaction of cresol given by Schneider (Pharm. Centr.-H. **34**, 716; and this Journal, 1896, 298). 20 grms. of the distillate (coming over chiefly at 187° C.) from the preparation sold as ***Kresolum pur. Nördlinger*** are mixed with 280 grms. of concentrated sulphuric acid, and 5 c.c. of the red coloured liquid treated with 2 c.c. of the water to be examined. After five minutes, 5 c.c. of distilled water are added, the mixture, after cooling, treated with 35 c.c. of ammonia, and made up to 50 c.c. or 100 c.c. The yellow coloration which is formed and which remains permanent for a day, varies, as regards intensity, with the amount of nitric acid present; it is compared with the coloration given by a water containing a known amount of nitric acid, when treated in a similar manner.—A. S.

Iron Oxide, Determination of, by Reduction with Sodium Thiosulphate and Titration with Iodine. J. T. Norton, jun. Amer. J. Science, Silliman, **8**, [4], 25—30; Chem. Centr. 1899, **2**, [5], 320.

Not more than 0·2 grm. of the oxide is dissolved in hydrochloric acid, and the solution evaporated to the consistence of a thick paste. The mass is dissolved in 800 c.c. of freshly boiled water, a drop of sodium sulphocyanide added, and 50 c.c. of $\frac{1}{10}$N sodium thiosulphate solution run in. If the liquid be completely decolorised, the excess of thiosulphate is determined by means of $\frac{1}{10}$N iodine solution. The process is stated to give accurate results for quantities of iron oxide up to 0·2 grm.—A. S.

Antimony, Determination of, in Ores. T. Brown, jun. J. Amer. Chem. Soc. 1899, **21**, [9], 780—789.

The antimony ores of Mexico most commonly met with in commerce are those of stibnite (Sb_2S_3); cervantite (Sb_2O_4), produced by the oxidation of the former; oxysulphides, mixtures of the two in which the sulphide predominates; and senarmontite (Sb_2O_3), which is of rarer occurrence.

The author classifies these ores into three groups, for the purpose of analysis, in accordance with their behaviour on being boiled with concentrated hydrochloric acid with the subsequent addition of a few drops of nitric acid:—(1.) The soluble ores (stibnite and senarmontite); (2.) The practically insoluble ores (cervantite); and (3.) The partially soluble ores (the oxysulphides, stibnite mixed with cervantite).

(1.) *The Soluble Ores.*—These are determined in the usual way, with the usual precautions in case of presence of lead.

(2.) *The Practically Insoluble Ores.*—In this case the decomposition is accomplished by fusion. One grm. of the finely divided sample is mixed with 8 to 10 parts of a flux consisting of equal parts of flowers of sulphur and sodium carbonate, introduced into a porcelain crucible, and covered with a thin layer of the flux. The covered crucible is placed in a muffle at bright red heat, and the mass fused for about 10 minutes, the heat being so regulated that at first, sulphur flames are scarcely visible about the edges of the lid, and at no period should the crucible be heated to more than perceptible incandescence on the side facing the source of heat.

The colour of the fused mass when cold should be green, not yellow, the latter indicating incomplete decomposition. It is dissolved in hot water, the insoluble residue of iron sulphide and other metallic sulphides filtered off, and the antimony determined as sulphide in the usual manner followed in the case of soluble ores.

(3.) *The Partially Soluble Ores.*—These are first treated as for soluble ores, and the antimony estimated in the acid solution. The residue, containing the undissolved oxide, is then fused, as in the valuation of oxide ores. According to the author, most Mexican so-called sulphide ores are really oxysulphides, and require the double treatment.

He considers that the low results obtained by the fire-assay method on sulphide ores render the latter valueless as a criterion of the amount of antimony actually present, although for the other ores it still remains the accepted method in trade, notwithstanding the fact that it is well known that higher results are given by the use of other mixed fluxes at a lower temperature. It is carried out in the following manner:—Five grms. of the powdered ore are mixed with 12 parts of potassium cyanide, and the mixture placed in a 10 grm. crucible and covered with salt. The fusion is made in a muffle at a bright red heat, the crucible being left there for 13 minutes. It is then removed, shaken to collect the globules of metal into one button, and allowed to cool, after which the crucible is broken and the button removed from the slag and weighed. From the author's tabulated results, it appears that the percentages thus obtained are invariably lower than those given by his fusion method. In the case of a sample of oxysulphide, the difference between the two was 18 per cent., whilst even with oxide ores it amounted to 7 per cent. in some instances.—C. A. M.

Bronzes, Analyses of. A. Fomin. J. russ. phys.-chem. Ges. **31**, 565—567; Chem. Centr. 1899, **2**, [9], 495.

The author gives a method for the analysis of bronzes, which has been tried on alloys containing 63—95 per cent. of copper; 0—20 per cent. of lead; 2—21 per cent. of tin; 0—21 per cent. of zinc; and not more than 2 per cent. of antimony, and 3 per cent. of iron. The bronze is rasped, and purified by means of a magnet 0·3 grm. of the powder is treated gradually in the cold, with 1·5 c.c. of nitric acid (sp. gr. 1·30), and the reaction finished on the water-bath. 3 c.c. of concentrated ammonium nitrate solution is added, the liquid evaporated to dryness, the residue dissolved in 15 c.c. of water, and the solution boiled and filtered. The filtrate is neutralised with ammonia, acidified with 1—2 drops of nitric acid, and filtered through the same filter. The precipitate, which is determined as SnO_2 (it contains antimony; not more than 0·9 per cent. of iron and 0·08 per cent. of copper calculated on the original substance), is washed with 80—100 c.c. of hot water. The ammonium nitrate should prevent the solution of antimony, and check the formation of basic copper salts. The filtrate is acidified with 30 drops of nitric acid (sp. gr. 1·3), and subjected to electrolysis (2 "Meidinger" elements = 0·14—0·34 ampère, 2 volts). After 3—4 hours, a further 5 c.c. of ammonium nitrate solution are added, in order to prevent the precipitation of the iron. The electrolysis is finished in 24 hours. The electrodes are rapidly washed twice with water, and once with alcohol, and dried for 15 minutes at 180° C., the copper electrode being brought to that temperature quickly, and the lead peroxide electrode, gradually. In the residual electrolyte, the iron is precipitated by ammonia, the filtrate evaporated to dryness, the residue ignited and titrated with NaOH in presence of phenolphthalein. In conclusion, the author gives a description of the electrodes used. The cathode is a perforated plate, bent in the form of a cylinder, with a bright surface; whilst the anode is in the form of a cone.—A. S.

Alloys of Tin, Antimony (Arsenic), Lead and Copper, Analysis of. E. Prost. Bull. Assoc. Belge des Chim. **13**, [7], 323—330.

The large proportion of tin in alloys of the "antifriction metal" type, complicating the separation of the arsenic group by the method recommended by Fresenius, the author proposes to work on the same lines as adopted by himself and van de Casteele for the analysis of commercial tin (this Journal, 1897, 827), up to the precipitation by hydrogen sulphide. The washed precipitate (from 0·6—0·7 grm. of substance) is dissolved by the gradual addition of 10 c.c. of concentrated hydrochloric acid, and about 1 grm. of potassium chlorate (allowed to act at first in the cold and afterwards at water-bath temperature). The insoluble residue of sulphur and paper-pulp is filtered and washed with water acidified with hydrochloric acid, the filtrate being neutralised with caustic potash, treated with 10 grms. of a concentrated solution of oxalic acid, and re-precipitated by hydrogen sulphide as before. This precipitate (P) is free from tin, the whole of which metal together with part of the lead, is now in solution in the several filtrates (solution F).

Precipitate P.—The moist precipitate is rinsed with a minimum of water, into a beaker and warmed on the water-bath with 10—15 c.c. of a 10 per cent. solution of sodium sulphide, until the sulphides of arsenic and antimony are dissolved, whereupon the solution is separated from the insoluble sulphides of copper and lead by filtration through the old filter. After reprecipitating the solution by acid, and redissolving in a minimum of hydrochloric acid and potassium chlorate, the *arsenic* is estimated as ammonium-magnesium arsenate in the usual manner. The residual filtrate, after being freed from the greater part of the contained ammonia, and acidified by hydrochloric acid, is treated so as to throw down the *antimony* as Sb_2S_5, which is then converted into antimonious chloride, and estimated as Sb_2S_3 in the ordinary way. The insoluble sulphides of lead and copper previously separated are dissolved in nitric acid and set aside (solution S).

Solution F.—After neutralising with ammonia, this solution is treated with 50 c.c. of ammonium polysulphide (sp. gr. 0·971), to secure the conversion of the tin into a sulpho-salt, the lead thereupon coming down as sulphide (with a few mgrms. of tin). This precipitate is left to subside for about 24 hours, and after separation, washing, suffusion with a little ammonium nitrate, and drying is carefully incinerated, the residue being fused with sodium carbonate and sulphur to bring the tin into the condition of sulpho-salt. It is then extracted with water, the solution being joined to the main solution, whilst the lead sulphide is dissolved in nitric acid, and united with solution S, wherein *lead* is determined as lead sulphate, and the *copper* by electrolysis or as sulphide.

The *tin* may be estimated by two methods; (1.) Part of the sulpho-alkaline solution is treated with an excess of acetic acid, heated till clear, and the precipitated tin sulphide washed with hot 1 per cent. solution of ammonium acetate, and finally converted into oxide by roasting. (2.) The stannic solution is well adapted for the electrolytic method of estimation, a low-intensity current furnishing a coherent deposit of tin on the platinum cathode, provided the amount of metal does not exceed 0·25 grm. per sq. decimetre of cathode surface. The deposition will be complete in about seven or eight hours, and the use of a fresh cathode for another hour is recommended, to test for the presence of any further tin in the solution, in preference to the usual employment of wet tests.—C. S.

Aluminium, A New Method for the Direct Determination of, in the Presence of Iron, Manganese, Calcium, and Magnesium. W. H. Hess and E. D. Campbell. J. Amer. Chem. Soc. 1899, **21**, [9], 776—780.

This is based on the fact that phenyl hydrazine precipitates aluminium quantitatively as hydroxide without a trace of the precipitate dissolving in an excess of the reagent, whilst at the same time it reduces any iron present to the ferrous state.

A weighed quantity of the sample is dissolved in the usual manner, the solution heated nearly to the boiling point and dilute ammonium hydroxide added until the precipitate formed just redissolves. A neutral saturated solution of ammonium bisulphite is then added drop by drop until the solution becomes colourless from the complete reduction of the iron. This bisulphite solution is made by passing sulphur dioxide into a cooled solution of ammonium hydroxide (1 : 1) until the liquid becomes yellow. It serves the purpose of reducing the iron, whilst the excess of sulphurous acid combines with the phenylhydrazine to form a salt which keeps the iron reduced and prevents its precipitation with the aluminium.

To the solution of the sample, which now has a strong odour of sulphur dioxide, one or two c.c. of phenylhydrazine are added. If this does not cause a permanent precipitate, it is advisable to add ammonium hydroxide, drop by drop, until the first signs of a permanent precipitate, and to complete the precipitation with a few more drops of phenylhydrazine.

The precipitate is collected on a filter and washed with warm water containing a little phenylhydrazine bisulphite. This washing liquid is prepared by adding to a few c.c. of phenylhydrazine a saturated aqueous solution of sulphur dioxide, until the precipitate formed at first is redissolved to a yellow solution. If after a few minutes any odour of sulphur dioxide is perceptible, a few drops of phenylhydrazine are added to neutralise the excess. This concentrated solution, which is said to keep indefinitely in a stoppered bottle, is used in the proportion of 5 to 10 c.c. in 100 c.c. of water.

The washing of the aluminium precipitate is continued until the washings are free from iron, or chlorine, if present. The precipitate is then dried on the filter in a platinum crucible and ignited, first gently, until the paper is completely burned, and then at a bright red heat, until the weight is constant. This precipitate will contain all the phosphorus pentoxide in the sample, so that the amount of this must be determined in a second portion and deducted.

Chromium is precipitated quantitatively by phenylhydrazine, which may thus be used to separate it from iron. Calcium, magnesium, manganese, cobalt, and nickel are not precipitated by it.

When a gravimetric estimation of iron is required, it has been found most suitable to add ammonium sulphide to the filtrate in the absence of other metals capable of being precipitated. The iron sulphide is filtered off, and without washing, redissolved in dilute hydrochloric acid, and the iron precipitated in the usual way with ammonia, after oxidation with nitric acid.

This method may also be conveniently used for the separation and estimation of phosphoric acid. If the aluminium in the sample is insufficient to carry down with it the whole of the phosphoric acid, an excess of a solution of aluminium chloride of known strength is added, and the aluminium subsequently separated as described above. If only the phosphoric acid be required, the precipitate may be dissolved in nitric acid, and the usual method of determination adopted. Or the precipitate may be ignited and weighed, thus giving the combined amount of aluminium in the mineral, added aluminium, and phosphoric acid.

A table is given in conclusion, showing the result of analyses of mixtures of known composition by this method. These results, which were obtained by an analyst who was ignorant of the composition, are very satisfactory.

—C. A. M.

Zinc, Electrolytic Determination of, in Presence of Manganese. E. J. Riederer. J. Amer. Chem. Soc. 1899, **21**, [9], 789—792.

The author has obtained the best results by using a platinum dish coated with silver as the cathode. During the deposition the solution should be continually stirred with a mechanical stirrer, and the temperature kept below 26° C.

In his experiments the current used was about 3·5 volts and 0·20 to 0·26 ampère. If the current be increased to more than 0·30 ampère $N.D._{100}$ the zinc will not be deposited evenly, and manganese hydroxide will be found on the anode and enclosed in zinc particles. On the other hand, if it be less than 0·20 ampère a longer time will be required. Under the above-mentioned conditions the author has made 16 separations of zinc from manganese, and in only two of these did the electrolysis require more than 5½ hours, or the results vary by more than 0·10 per cent. from theory.

The following reagents were used in each case: (*a*) a solution of lactic acid containing 0·937 grm. per c.c.; (*b*) a solution of ammonium lactate containing 0·5 grm. in 1 c.c.; and (*c*) crystalline ammonium sulphate.

The following outline of an analysis illustrates the author's method:—

Zinc sulphate..................	0·5074 grm.
Manganese sulphate..........	0·1634 grm.
Ammonium lactate	5·0000 grms.
Lactic acid	0·7500 grm.
Ammonium sulphate..........	2·0000 grms.
Ampere varying from	0·24 to 0·26 $N.D._{100}$
Voltage varying from	3·7 to 3·9.
Temperature varying from	20° to 25° C.
Percentage of zinc found	22·786.
Percentage of zinc theory	22·78.
Time required..................	4 hours 10 minutes.

The solution from which the zinc is deposited should always be neutral or slightly acid.—C. A. M.

Magnesium, A New Volumetric Method of Determining. R. K. Meade. J. Amer. Chem. Soc. 1899, **21**, [9], 746—752.

In this method the magnesium is first precipitated as magnesium ammonium arsenate, the precipitate dissolved in dilute hydrochloric acid, the arsenic acid reduced to arsenious acid as in Williamson's method of determining arsenic—

$$As_2O_5 + 4KI + 4HCl = As_2O_3 + 4KCl + 2H_2O + 2I_2$$

and the liberated iodine titrated with standard thiosulphate.

The solution of the magnesium salt, which should not contain too great an excess of ammonium chloride or ammonium oxalate, is mixed with a third of its volume of strong ammonium hydroxide and 50 c.c. of a 10 per cent. solution of sodium arsenate, and the whole well shaken for about 10 minutes in a stopped flask. The precipitate is allowed to subside for a short time, and is then collected on a filter and washed with a mixture of water and ammonium hydroxide (3 : 1) until the washings no longer show an arsenic reaction, care being taken to avoid an excess of the washing liquid. It is then dissolved in dilute hydrochloric acid (1 : 1), the filter paper being washed with the same acid until the washings and solution amount to from 75 to 100 c.c.

When cool, from 3 to 5 grms. of potassium iodide (free from iodate) are introduced, the solution allowed to stand for a few minutes, and the liberated iodine titrated with standard thiosulphate in the usual manner. In conclusion the author gives the results obtained by this method and by the ordinary gravimetric process in the analysis of a number of samples of minerals and cements, the agreement in which is as a rule closer than 0·1 per cent.

The time required for the entire determination is stated to be about 45 minutes.—C. A. M.

Cyanide Solutions, Estimation of Protective Alkali in. A. F. Crosse. J. of the Chem. and Metall. Soc. of S. Africa, 1899, **2**, 97—98.

See under X., *page* 1022.

ORGANIC CHEMISTRY.—QUALITATIVE.

Benzidine and Tolidine, Colour Reaction for the Recognition of. J. Wolff. Ann. Chim. anal. appl. **4**, 263; Chem. Centr. 1899, **2**, [11], 569.

A small portion of the substance is treated in a small test tube with 1 c.c. of glacial acetic acid, the mixture diluted with water till the tube is three-quarters full, and a few drops of an aqueous peroxide of lead paste added. There is formed immediately a magnificent blue coloration, which is permanent in the cold, but disappears on warming. Other organic acids, as citric, tartaric, and oxalic acids, give a similar coloration, but not so strongly.

Under the same conditions an addition of bromine also causes the formation of a blue colour, and with larger quantities, a copious blue precipitate. Neither lead peroxide nor bromine give the coloration in presence of dilute mineral acids. The colour is destroyed by the addition of ammonia, but is again formed on acidifying with acetic acid.—A. S.

Sesamé Oil, New Colour Reactions of. J. Bellier. Ann. Chim. anal. appl. **4**, 217—220; Chem. Centr. 1899, **2**, [8], 453.

Of the numerous reagents which have been proposed for the detection of sesamé oil, that of Tocher appears to be the only one which is sufficiently sensitive and, at the same time, does not also give a reaction with certain varieties of olive oil. Equal volumes of the oil and of a mixture of 14 c.c. of hydrochloric acid and 1 grm. of pyrogallol are shaken together, the acid decanted off, and boiled for five minutes. In presence of sesamé oil, a dark purple coloration is formed varying in depth with the proportion present.

On shaking together equal volumes of sesamé oil and of a mixture of 100 c.c. of sulphuric acid, 50 c.c. of water, and about 10 c.c. of a 40 per cent. solution of formaldehyde, a very permanent dark blue colour is gradually formed. With olive oil, earth-nut (arachis) oil, cotton-seed oil, poppy-seed oil, walnut oil, and linseed oil, the reagent becomes of a more or less intense yellow colour. With 2 per cent. of sesamé oil, the emulsion is a tolerably dark gray, and the acid which separates, dark brown. With 5 per cent. the emulsion is dark grey, with 10 per cent., perfectly black; the acid which separates is black inclining to blue. This reaction allows of the detection of 1 per cent. of sesamé oil.—A. S.

Sesamé Oil, Detection of. A. Bömer. Zeits. f. Untersuch. Nahr. und Genussmittel, 1899, **2**, [9], 705—709.

According to the researches of Villavecchia and Fabris, the unsaponifiable portion of sesamé oil consists of phytosterin, sesamin and a red oil which is the cause of the Baudouin reaction. From the ethereal extract of the aqueous-alcoholic soap solution a crystalline mixture of phytosterin and sesamin is obtained, from which the phytosterin can be removed by washing with ether, in which it is far more soluble than sesamin. The residue, consisting of pure sesamin, is colourless, and crystallises either in round irregular crystals or more frequently in compound masses of needles thicker than those of phytosterin. A simple test to distinguish between crystals of phytosterin and sesamin when mixed, consists in treating the dried substance under the microscope with a mixture of equal parts of acetic anhydride and concentrated sulphuric acid. The crystals of sesamin become coloured, and change through brown-green, blue-green, and cherry-red to reddish-blue, gradually losing their shape and becoming almost dissolved, whilst those of phytosterin remain unchanged both as to form and colour. The function of the acetic anhydride is merely that of a diluent, since sulphuric acid alone produces similar colorations. The author has compared the behaviour of solutions of cholesterin, phytosterin, and sesamin in chloroform when treated with concentrated sulphuric acid. Sesamin is only slightly reactive, fatty esters could not be obtained, though some reaction took place on heating with formic or propionic acid in sealed tubes. Pure sesamin melts at 120°—122° C., but a slight contamination with phytosterin lowers the melting point considerably. It is strongly dextrorotatory, and the slight dextrorotation of sesamé oil is due to this constituent. Sesamé oil contains 0·2—0·5 per cent. of sesamin, but satisfactory quantitative determinations could not be made. The mother liquors from the phytosterin and sesamin contain the red oil. If the ethereal solution of these mother liquors be treated with purified animal charcoal, and the charcoal subsequently extracted with ether, a brown resinous substance is obtained, which gives the Baudouin reaction in dilutions of 1 in 500,000. Animal charcoal will also remove this constituent from the natural sesamé oil, so that it no longer gives the Baudouin reaction. The same change occurs if sesamé oil be heated for a long time (8 days) on the water bath, and if sesamé oil is to be detected in margarine by this test, the clarification of the fat should be performed with as little heating as possible.—J. F. B.

Sawdust in Flour and Bran, Detection of. G. A. Le Roy. Ann. Chim. anal. appl. **4**, 221; Chem. Centr. 1899, **2**, [8], 454.

The author uses as reagent a mixture of 15 c.c. of 90—95 per cent. alcohol, 15 c.c. of water, 10 c.c. of syrupy phosphoric acid, and 1 grm. of phloroglucinol. 1—2 c.c. of the reagent is treated in a porcelain capsule with a pinch of the product to be examined, and the mixture gently warmed. In presence of sawdust a red coloration is soon formed, which gradually becomes more intense. The normal constituents of flour and bran give only a very faint coloration. —A. S.

Tartaric Acid and its Compounds, Colour Reaction for Recognising, and Distinction from Citric Acid. J. Wolff. Ann. Chim. anal. appl. **4**, 263; Chem. Centr. 1899, **2**, [11], 569.

The author describes a reaction for the detection of tartaric acid, which he believes is forgotten. A few centigrams of resorcinol are carefully warmed in a perfectly dry porcelain capsule with a little sulphuric acid till vapours are evolved, and then a small quantity of the tartaric acid added. An intense dark red colour is formed, sometimes only after again warming. The colour disappears on addition of water. Oxalic and citric acids and their salts do not give a similar coloration.—A. S.

Alkaloids, New Reagent for Detection of Opium. Mecke. Zeits. öffentl. Chem. 1899, **5**, 351; through Chem. Zeit. Rep. 1899, **23**, [28], 273.

The author finds that a solution of selenious acid in concentrated sulphuric acid (about 0·5 grm. in 100) is a delicate reagent for many alkaloids. It gives characteristic colour reactions with colchicine, digitaline, veratrine, and especially with the opium alkaloids. The new reagent is stated to be more sensitive than those usually employed, and gives a distinct green colour with 0·005 mgrm. of morphine and codeïne, especially if the bases are impure, as is generally the case in practice. This reagent has the advantage that the coloration appears immediately and in the cold. In colour reactions, when the sulphuric acid has to be heated, the extractive matter often causes a brown colour, which disguises the reaction, especially the red; the green coloration which this reagent gives with morphine and codeïne can readily be distinguished even in brown solutions. —J. F. B.

Cocaïne Hydrochloride. Zimmer and Co. Pharm. Zeit. 1899, **66**; through Pharm J. 1899, **63**, [1527], 315.

The authors confirm the view that Maclagan's test gives the best indication as to the purity of cocaïne hydrochloride, and contradict Günther's assertion that the pure hydrochloride should give no precipitate with ammonia in the dilution required in Maclagan's reaction. A pure salt should yield a crystalline precipitate in half a minute, and when a salt does not give a crystalline precipitate within five minutes it should be rejected as being too impure. The authors also state that they have never met with Günther's isomeric ethyl-benzoyl-ecgonine, melting at 111° C., in cocaïne products, and they consider that its existence in the alkaloids of the coca leaf must be regarded as doubtful. In proof of its non-existence in cocaïne hydrochloride which answers Maclagan's test, 100 grms. were recrystallised from absolute alcohol, and the base fractionated several times from petroleum spirit. In all the fractions, the alkaloid obtained had a melting-point approximating to that of pure cocaïne.—A. S.

Vanilla, Distinction of True Extract of, from Liquid Preparations of Vanillin. W. H. Hess. J. Amer. Chem. Soc. 1899, **21**, [9], 719—723.

Apart from its superior flavour and aroma, the extract of the vanilla bean differs from artificial preparations in containing a number of other constituents than vanillin, but noticeably a characteristic resin, which, in the author's opinion, it would be very difficult to replace, and which therefore affords a valuable means of determining the purity of a given sample.

This resin is of a dark red to brown colour, and is present in the bean to the extent of from 4 to 11 per cent., whilst it composes about half of the colouring matter of the tincture of vanilla. As a dark-coloured product is usually required, the manufacturers attempt to get as much as possible of the resin into solution. As it dissolves in 50 per cent. alcohol, the better class of extracts, in which plenty of alcohol is used, naturally contain it, whilst in the cheaper extracts, alkali, usually potassium bicarbonate, is often employed to assist the weaker alcohol employed in dissolving the resin and gum, and to prevent turbidity. According to the author, this treatment impairs the flavour of the vanillin, which is acted upon by the bicarbonate, so that a disagreeable foreign odour is produced.

The following simple tests are recommended as giving useful indications as to the origin of a preparation:—When a few c.c. of the tincture are shaken with three volumes of water, a flocculent red precipitate will separate if no alkali has been used in the manufacture. There should be but a slight turbidity, for any milkiness would point to the presence of foreign resin. On adding hydrochloric acid, drop by drop, to the diluted liquid, there is an immediate turbidity, caused by the extracted matter held in solution by the plant bases, but in the absence of foreign resin this turbidity should be slight. Where alkali has been used in the manufacture, the turbidity increases considerably, and the colour will fade when acid is added.

In order to separate and identify the resin, 25 c.c. of the extract are evaporated on the water bath until all the alcohol is expelled, the residue being made up to about its original volume with water. When alkali has not been used in the manufacture, the resin will now appear as an amorphous, flocculent red or brown precipitate, and on acidifying the liquid with hydrochloric acid, separates out completely. The supernatant liquid becomes clear and partly decolorised after standing for a short time, but if a quantitative estimation of the resin is required, the complete separation takes several hours.

The resin is collected on a filter and washed with water, the filtrate being reserved for further examination. The resin of the vanilla bean dissolves in potassium hydroxide solution forming a deep red coloration, and is reprecipitated on acidifying the liquid. When dissolved in alcohol and tested with ferric chloride or hydrochloric acid, it differs from most resins in showing little, if any, change in colour.

The filtrate from the resin is tested for colouring matters, such as caramel or azo dyes. A portion of it is concentrated on the water bath until its colour closely approximates that of the original tincture. A few drops of strong hydrochloric acid are then added, and the liquid gently heated. If caramel be present, a yellowish-red flocculent precipitate is formed, which is filtered off from the cool liquid and washed. It is insoluble in water, strong alcohol, or ether, but is soluble in a dilute solution of potassium hydroxide, in glacial acetic acid and in dilute alcohol. About half the colour of the caramel is thus removed. The author also recommends the following method of examining commercial extracts for resin and caramel. The solution freed from alcohol is rendered slightly acid with hydrochloric acid, and digested for a few minutes on the water bath, with the result that both resin and caramel are precipitated. The precipitate is collected on a filter, washed with water and dried on the paper at a low temperature. It is then washed with absolute alcohol as long as any colour is removed, this treatment removing the resin and leaving the caramel. The filtrate after removal of the alcohol leaves a residue which is examined as described above. The residue on the filter can be identified as caramel, by dissolving it in hot dilute acetic acid and adding phenylhydrazine, which produces a characteristic reddish-brown precipitate. In order to detect the presence of an azo dye, a small portion of the filtrate from the resin is treated with ammonia, which in the case of a natural product greatly increases the colour. On now adding zinc dust and digesting, the colour should not fade altogether, even on warming, but should assume a tint of about the same intensity as that of the liquid before the addition of ammonia. On the other hand if the colour was due to an azo compound, the treatment with zinc dust will completely decolorise the liquid, the colour being restored by the action of oxidising agents.

A portion of the filtrate from the resin should also be tested for tannin, which should not be present in great excess. A considerable precipitate should also be obtained on adding lead acetate to another portion, indicating the presence of a considerable proportion of organic acids and extractives. This precipitate will contain nearly all the colouring matter left in the filtrate from the resin.

The best test for the presence of extract of tonka bean, which is a frequent adulterant of vanilla extract, is to identify its odoriferous constituent, coumarin. (This Journal, 1899, 525.)—C. A. M.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Bitumens, Determination of Sulphur in. S. F. and H. E. Peckham. J. Amer. Chem. Soc. 1899 [9], 772—776.

The authors call attention to a number of conditions which, in their opinion, render the modification of Carius' method, described by E. H. Hodgson (this Journal, 1899, 77), liable to yield variable and, to some extent, unreliable results. Thus, in the analysis of the samples of Trinidad Lake pitch, they point out that there can be no question that the action of nitric acid on the complex mixture of various substances present will almost certainly result in the formation of oxides of aluminium and iron, which will form double barium salts with sulphuric acid, which will be weighed with the barium sulphate. They also object to the use of a porcelain crucible in the deflagration method, firstly on account of its form, and secondly because the fluxes will act upon the porcelain, and make it impossible to determine the iron, aluminium, and silica in the assay.

In the light of recent experiments they have modified their method (this Journal, 1897, 424 and 996), and give the following outline of their modifications :—A quantity of the sample, representing 0·5 grm. of bitumen, is thoroughly mixed with 15 grms. each of pure dry sodium carbonate and potassium nitrate, and the mixture introduced in small portions at a time into a platinum crucible brought to a dull red heat. No assistance from a blast is required, and the mass is in a state of quiet fusion when the last portion has deflagrated.

The contents of the crucible are dissolved by leaving it in a beaker of water, preferably over-night. The crucible is then washed out, and the solution acidified with hydrochloric acid, and evaporated to dryness on the water-bath. After being dehydrated in the usual manner, the silica is filtered off, ignited, and weighed.

The filtrate is rendered alkaline with ammonium hydroxide, boiled until the excess of ammonia is removed, and the precipitate of iron and aluminium dried and weighed as usual. The iron may be determined by titration with permanganate in another portion, and the aluminium calculated by difference. If required the lime may be determined as oxalate.

The solution freed from silica, iron, aluminium, and calcium is heated to boiling, rendered acid with hydrochloric acid, and the sulphuric acid precipitated with barium chloride, added little by little from a pipette.

The authors state that they have not experienced the slightest difficulty in obtaining results which agree to the second place of decimals by this method.—C. A. M.

Naphtha, Determination of Sulphur in. A. Lidow. J. russ. phys.-chem. Ges. **31**, 567—70; Chem. Centr. 1899, **2**, [9], 493.

The author gives a simple method for the determination of sulphur in naphtha. 1 grm. of the naphtha is dissolved in pure ether and mixed in a mortar with 30 grms. of a mixture of 17 parts of potassium nitrate and 13 parts of sodium carbonate. After evaporating off the ether, the mass is heated, in small portions, in a platinum crucible, almost to redness. Fresh portions are only added after complete combustion of the material already in the crucible. The sulphuric acid is then determined in the usual manner. Naphtha from Orta-Uitasch gave, by Engler's method, 0·37; by Carius' method, 0·34; by burning in a current of oxygen in a tube with platinised pumice stone, 0·37; and, by the author's method, an average of 0·44 per cent. of sulphur.
—A. S.

Quinones derived from Benzene, Volumetric Determination of. A. Valeur. Comptes Rend. **129**, [15], 552—553.

The principle of the method lies in the reduction of the quinone by hydriodic acid, and the titration of the liberated iodine by standard thiosulphate solution. An amount of the quinone corresponding to 0·2—0·5 grm. of iodine is weighed off and dissolved in 90 per cent. alcohol. To 20 c.c. of 10 per cent. solution of potassium iodide are added 40 c.c. of a cooled mixture of equal volumes of strong hydrochloric acid and 90 per cent. alcohol, and the mixture is at once poured into the quinone solution. The liberated iodine is determined by N/10 thiosulphate solution in the usual way. The method has given accurate results with quinone, dichloroquinone, toluquinone, and thymoquinone, as also with phenoquinones and quinhydrones. From the result of the titration of ordinary quinhydrone, the author concludes that it is a compound of quinone and quinol (hydroquinone) in equimolecular proportions.
—J. T. D.

Sulphur, Estimation of Small Quantities of, in Volatile Organic Substances. R. Lucion. Bull. Assoc. Belge des Chim. **13**, [6], 290—293.

Having found the bomb-combustion method, recommended by Filiti, defective by reason of the fusion of the enamel lining, the author has adopted the following procedure for the estimation of small quantities of sulphur in such bodies as petroleum spirit :—

For quantities up to ½ per cent. of sulphur, the method is very accurate, 98·6 per cent. of the total sulphur being recovered; but above that limit, the waste of sulphur arising from imperfect combustion, is considerable.

A current of hydrogen, purified by basic lead acetate and calcium chloride, is passed into a flask containing a weighed quantity of substance enclosed in a sealed tube. The latter being broken, the mixed gases are led through an ordinary combustion tube heated to redness, a current of dried and purified air, in the proportion of 8 vols. to 1 of the hydrogen, being also delivered into the combustion tube a little in the rear of the hydrogen supply. The products of combustion are drawn off by an aspirator and passed through ammonia, a cylinder filled with glass beads, and a washing flask. The operation takes from three to six hours to consume 2—3 c.c. of substance, and the mixture of ammonium sulphate and sulphite obtained is oxidised by bromine, precipitated by barium sulphate, and weighed in the usual manner.—C. S.

Iodine Value, Notes on the Determination of. J. Lewkowitsch. Analyst, 1899, **24**, [10], 257—259.

In this communication the author summarises the present position of this question. After pointing out that the work of Wijs (this Journal, 1898, 610, 698; 1899, 405) confirmed Ephraim's theory (Zeits. angew. Chem. 1895, 254) as to the addition of iodine chloride to the unsaturated carbon atoms of the fat during the process, he states that in his opinion, Wijs' contention that the active agent in the Hübl solution is hypo-iodous acid is not entirely borne out by experiments, and that for all practical purposes it is sufficient to adopt the explanation that iodine chloride is absorbed by each pair of doubly-linked carbon atoms.

Wijs has recently employed a solution of iodine chloride in glacial acetic acid in place of the solution in 95 per cent. acid first proposed by him, and the author confirms the advantage of the new solution by the results of a series of experiments which show that it is very much more stable and remains practically unaltered after two months, whereas a solution of iodine and chlorine in 95 per cent. acetic acid began to decrease in strength after 16 hours.

In order to compare the iodine values obtained by both methods, the author procured from Wijs a specimen of the allyl alcohol, which was referred to in one of that author's papers (this Journal, 1898, 699), and the results found by Peck were:—

Wijs' Method.

Solution of $ICl_3 + I_2$	419·09
Solution $I_2 + Cl_2$	420·09

Hübl's Method.

Solution 2–3 days old	421·27—422·17

The iodine value found by Wijs was 425.

Similar parallel determinations of the iodine value of pure elaidic acid (melting point, 44·5° C.) gave by Wijs' method 88·66—88·93, and by Hübl's method 88·24. From these experiments and others with cotton-seed stearin, the author concludes that Hübl's method applied in the proper manner gives correct results, but that, as has been shown by Wijs, the Hübl solution must be allowed to stand for a day before use, and its time of action on the fat must not exceed 6 or 7 hours.

Wijs' process he regards as a very valuable one, possessing as it does the advantages that the solution can be prepared very rapidly and that the time required for the absorption is greatly reduced.—C. A. M.

Tanning Materials, Analysis of. J. Paessler. Deutsche Gerber Zeit. **42**, [116] and [117].

The value of the analysis of tanning materials has been the subject of much argument, and it is a common idea in the trade that tanning materials cannot be so analysed that two chemists working from one sample will get identical results. The writer, speaking from an experience dating over many years, whilst admitting frequent discordance in chemists' results, shows that this commonly arises from a want of technical knowledge on the part of the trade itself, in that the disagreeing chemists have not worked from the same sample, though they were supposed to have done so, but from two samples drawn from the same bulk, which is a very different thing, and he strongly emphasises the necessity of samples being drawn by a responsible and competent person.

The International Association of Leather Trades' Chemists, at their conferences in London, Freiberg, and Copenhagen have laid down definite instructions for the sampling of all materials used in the manufacture of leather. One example from many, commercial valonia. The "beard" contains a much higher percentage of tannin than the "cups," yet in the drawing of a sample, the trade seldom pays attention to the proportion of cup and beard which exists in the bulk, and from which the sample is being drawn for analysis. In a commercial sample of valonia beard recently analysed, was found pieces of myrobalans, maize, seeds of different plants, small pieces of stone, leaves, and numerous pieces of the stem. To illustrate the difficulty of getting a correct sample from such valonia beard, a sample shaken in a glass cylinder, divided itself into five layers, and became thus, in fact, five different samples. The results of analyses, given in table I. show that the different layers contain different quantities of tannin and other substances.

Table I.

—	A 25 cm. Column of Valonia "Beard," divided into Five Layers.					Average of "Beard."	Outer Scale of Commercial "Beard."
	I. Top, 3 cm.	II. 2nd, 5 cm.	III. 10 cm.	IV. 5 cm.	V. Bottom, 3 c.m.		
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Tanning substances	39·15	39·95	39·00	34·92	39·93	38·80	47·97
Soluble non-tannins	14·39	13·44	13·98	13·75	13·74	14·14	14·37
Insoluble	31·96	32·11	32·82	36·83	31·83	32·56	23·16
Water	14·50	14·50	14·50	14·50	14·50	14·50	14·50
	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ash free from sand	3·38	3·46	3·28	3·38	3·27	3·29	2·44
Sand	2·19	2·64	2·79	6·65	2·29	2·54	0·19

There are, however, many sources of error which must be avoided in the carrying out of the analysis once the sample has been received by the chemist, and not the least important is the filter paper used for filtering the solution previous to the evaporation. The Int. Assoc. L. Tr. Chemists, after considerable research by various of its members, found that Schleicher and Schüll's filter paper No. 602 was the most satisfactory for this purpose. Filter paper No. 597, made by the same firm, as the following table shows, has a very decided and important action in the filtration of tanning liquors. The analyses given on the next page show the differences obtained by filtering the same solution through the two filter papers 602 and 597.

In the case of quebracho extract, a difference in result is obtained of over 10 per cent. The addition of "kaolin" to the liquor, in order to obtain a clear filtrate, has an even more disastrous action, so that the above-named Association has recommended that the use of kaolin be discontinued. These results show the absolute necessity of chemists adhering even in the minutest details to the "standard methods," not only in the general method of analysis, but even in such details of filtration.

The most important factor is the quality of the hide-powder used in the process. The different qualities of hide-powders in the market have a great deal to do with the discrepancy of analytical results. The writer now uses hide-powder specially prepared, and with which is mixed 12 per cent. of cellulose. This has been found to obviate many of the difficulties which other hide-powders possess, and for such a material it is claimed that the speed with which the filtrate is allowed to percolate through the hide filter has little or no action upon the result obtained. Skill in packing

TABLE II.

Differences in Analytical Results by the Use of 602 and 597 Filter Paper, S. & S.

—	Pine Bark.		Mimosa Bark.		Mimosa Bark.		Chestnut-wood Extract.		Chestnut-wood Extract.	
	No. 602.	No. 597.	No. 602.	No. 597.	No. 602.	No. 597.	No. 602.	No. 597.	No. 602.	No. 597.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Tannin matters	12·87	14·04	30·14	32·52	34·34	35·69	27·63	27·82	26·34	27·14
Soluble non-tannins	9·24	9·30	9·57	9·55	10·25	10·26	8·58	8·58	8·50	8·45
Insoluble	63·89	62·66	47·71	45·35	44·04	42·68	0·09	0·00	1·67	0·92
Water	14·00	14·00	12·58	12·58	11·37	11·37	63·70	63·60	63·49	63·49
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Difference	1·17		2·38		1·35		0·19		0·80	

—	Chestnut-wood Extract.		Oakwood Extract.		Quebracho Extract.		Quebracho Extract easily Soluble.	
	No. 602.	No. 597.	No. 602.	No. 597.	No. 602.	No. 597.	No. 602.	No. 597.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Tanning matters	32·17	36·69	26·06	39·95	34·44	44·87	34·50 } 39·92	40·15
Soluble non-tannins	4·29	..	15·44	..	7·23		5·42 }	..
Insoluble	0·39	0·16	0·45	0·00	3·27	0·07	0·00	0·00
Water	63·15	63·15	60·05	60·05	55·06	55·06	60·08	60·08
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Difference	0·23		0·45		3·20		6·23	

—	Quebracho Extract.		Quebracho Extract.		Solid Quebracho Extract.			Sumach Extract.	
	No. 602.	No. 597.	No. 602.	No. 597.	No. 602.	No. 597.	No. 597 used double.	No. 602.	No. 597.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Tanning matters	31·72	47·70	31·15	43·67	65·60	72·10	69·80	25·27 } 43·64	45·91
Soluble non-tannins	5·71		4·39		..	..	..	18·37 }	
Insoluble	11·29	1·02	10·00	1·87	17·07	10·57	12·87	3·88	1·61
Water	51·28	51·28	54·46	54·46	17·33	17·33	17·33	52·48	52·48
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Difference	10·27		8·13		6·50		2·30	2·27	
					4·20				

the hide filter is not requisite. A hide filter having a capacity of 28 c.c. (Procter's form) holds about 9 grms. of such a powder, and the liquor should be allowed to percolate at such a speed that about 10 drops per minute would pass over, so that the 90 c.c. necessary for the analysis take between 2 and $2\frac{1}{2}$ hours. A table given shows the very slight differences obtained from the analysis of a valonia liquor, allowing it to pass through the hide filter at varying speeds.

Another factor, which also has an influence upon the results, is the temperature of the laboratory in which the analysis and filtration are carried out. A solution of quebracho extract was divided up into four portions, each portion being analysed at the different temperatures shown in the following table:—

TABLE III.

Showing Effect of Analysis by Different Temperatures.

—	At 10° C.	At 15° C.	At 20° C.	At 25° C.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Total solids	63·70	65·60	66·20	71·40

As a temperature of about 17·5 is the one, perhaps, most easily obtainable, it would be well if this temperature, which is the one approved of by the Int. Assoc. Leather Tr. Chemists, is rigidly adhered to by those chemists who undertake the analysis of materials for the leather trade.

—J. G. P.

Invert Sugar in Presence of Cane Sugar, Estimation of. Jessen-Hansen. Carlsberg Laborat. Medelelser, 1899, **4**, 314; through Chem. Zeit. Rep. 1899, **23**, [28], 273.

BRÜHNS (this Journal, 1899, 407) came to the conclusion that Kjeldahl's method is useless for the estimation of invert sugar if cane sugar be also present, on account of the cupric reducing effect of the latter sugar when heated under Kjeldahl's conditions. The author finds that useful results may be obtained by applying a few modifications. He recommends that double the quantity of Rochelle salt be used, and that the time of heating be shortened to five minutes. In this way the copper reduced by 10 grms. of cane sugar is only about 14 mgrms., as compared with 110 mgrms. by Kjeldahl's ordinary method, and if the time be accurately measured with a seconds-watch, concordant results can be obtained.—J. F. B.

Golden Syrup, Analysis of. R. Bodmer, N. Leonard, and H. M. Smith. Analyst, 1899, **24**, [10], 253—257.

ASSUMING genuine golden syrup, which is usually regarded as a product of the partial hydrolysis of cane sugar alone, to have a specific rotation $[\alpha]_D = + 16°$, and glucose syrup to have $[\alpha]_D = + 110°$, an approximate idea of the composition of a mixture may be obtained by determining the rotatory power, and calculating the percentage of glucose syrup from the formula—

$$\frac{100([\alpha]_D - 16)}{110 - 16.}$$

For a more complete analysis, the following method is recommended:—The water is estimated by determining the specific gravity of a 10 per cent. solution, and calculating the percentage by means of the factor 3·86.

The rotatory power is determined in a 200 mm. tube in a 10 per cent. solution, and the specific rotation calculated by multiplying the observed angle by 5. Three determinations of the reducing power are made: (*a*) in the original 10 per cent. solution; (*b*) after inversion of the cane sugar by heating 10 c.c. of the solution diluted to 50 c.c. with water containing 5 c.c. of concentrated hydrochloric acid for 10 minutes, at a temperature not exceeding 68° C.; and (*c*) after inversion of the cane sugar, dextrin, and maltose by heating 10 c.c. of the solution diluted to 50 c.c. with water containing 1·5 c.c. of sulphuric acid for two or three hours on the water-bath. The reducing powers thus determined are expressed in percentages of glucose on the original syrup, and termed K_1, K_2, and K_3 respectively.

The amount of ash is determined by evaporating 10 to 20 c.c. on the water-bath with a few drops of sulphuric acid, igniting the residue, and deducting one-tenth from the final weight.

As it was found impossible, on account of impurities, to calculate the amounts of invert sugar, maltose, and dextrin from the optical rotation and reducing power before and after inversion of mixed syrups, the authors consider that the composition of a sample may be conveniently determined by assuming that anhydrous commercial "glucose" has a cupric reducing power of 53, and specific rotation of $[\alpha]_D = +134°$ in sodium light (*cf.* Boseley, Analyst, 1898, 125).

Thus, if s represent the percentage of cane sugar ($K = 0$, $[\alpha]_D = +66·5°$), i that of invert-sugar ($K = 100$, $[\alpha]_D = -23·1°$), and x the commercial glucose, the following equations are arrived at:—

$$K_1 = i + 0·53\,x$$

$$K_2 = i + 0·53\,x + \frac{100\,s}{95}$$

$$[\alpha]_D = \frac{66·5\,s + 134\,x - 23·1\,i}{100}$$

whence—

$$s = \frac{95(K_2 - K_1)}{100}$$

$$x = 0·685[\alpha]_D + 0·16\,K_1 - 0·455\,s$$

$$i = K_1 - 0·53\,x.$$

—C. A. M.

Formaldehyde, Detection and Estimation of. C. Neuberg. Ber. 1899, **32,** [11], 1961—1964.

The base *p*-dihydrazinodiphenyl described by Fischer and Arheidt gives a characteristic, bright yellow hydrazone, having a composition corresponding to $(C_6H_4HN.N:CH_2)_2$. This hydrazone is insoluble in the usual solvents, but is decomposed by mineral and strong acetic acids. When heated in a capillary tube it turns orange at 166° C., sinters at 202° C., and melts unsharply at 220° C. to a brown mass, which slowly decomposes at 240° C. The reaction readily serves for the detection of formaldehyde in concentration of 1:5000, but becomes uncertain at 1:8000. Although the phloroglucinol and resorcinol tests for formaldehyde are more delicate, they give identical colorations with furfural, but this reaction has the advantage of being applicable in presence of any other aldehydes or ketones. In this case the other hydrazones are kept in solution by adding to the liquid to be tested double its volume of alcohol, or else by extracting the precipitated hydrazones with strong alcohol until the residue has a pure yellow colour. For qualitative tests the hydrazine base may be prepared in the crude state as required from benzidine, but for quantitative work, only the purest, recrystallised, colourless hydrochloride of the base may be employed. To a cold aqueous solution of the hydrazine salt, the formaldehyde liquid is slowly added whilst stirring, and the mixture is then warmed during 15 minutes up to a temperature of 50°—60° C. The precipitated hydrazone is filtered off on a Gooch crucible and washed with hot water, alcohol, and absolute ether successively, and then dried at 90° C. Good quantitative results are only obtainable when the solution contains 1—2 parts of formaldehyde to 1,000 of water; an average of three determinations gave 98·62 per cent. of the theoretical. In spite of this somewhat large error the method is the only one which can be used for the estimation of formaldehyde in presence of other aldehydes, ketones, or acids. For this purpose a quantity of absolute ethyl, or preferably methyl alcohol, equal to or double the volume of the liquid, according to the proportion of other substances present, is added before mixing with the hydrazine salt. The subsequent procedure is the same as above, and the other hydrazones remain in the filtrate. The volumetric method of Blank and Finkenbeiner may be applied for the estimation of the aldehyde by double titration of the hydrazine with iodine and thiosulphate.—J. F. B.

Hydrazine, New Method for the Determination of. E. Rimini. Gaz. chim. ital. **29,** [1], 265—269; Chem. Centr. 1899, **2,** [8], 455.

Of the methods at present in use for the determination of hydrazine, the author considers that of Hofmann and Küspert (this Journal 1898, 188) to be the best. The author gives a new method based on the following reaction between an iodate and hydrazine salts:—

$$5NH_2.NH_2.H_2SO_4 + 4KIO_3 =$$
$$5N_2 + 12H_2O + 2K_2SO_4 + 3H_2SO_4 + 4I.$$

The hydrazine salt is heated over the direct flame with a suitable quantity of an iodate, until the liquid becomes colourless. After cooling, and acidifying with dilute sulphuric acid, the iodine set free is titrated with thiosulphate. The author is of the opinion that this rapid, volumetric method may also be employed for the determination of hydroxylamine and semicarbazide.—A. S.

Syntonin, Albumoses and Peptones, Estimation of. J. Effront. Bull. Soc. Chim. 1899, **21,** [14], 680—683.

For the analysis of crude peptone the author proceeds as follows:—

A 5 per cent. solution of the sample in water is prepared. 50 c.c. of this solution is exactly neutralised with soda, allowed to stand for some hours, and the precipitate of syntonin collected on a tared paper, washed with water, then with absolute alcohol, dried at 100° C., and weighed. The precipitate always contains ash, which must be determined and allowed for.

Another 50 c.c. of the solution is neutralised as before, diluted to 55 c.c., and after some hours, filtered. To 44 c.c. of the filtrate (= 40 c.c. of the original solution), 8 c.c. of normal hydrochloric acid is added, then, gradually 250 c.c. of 95 per cent. alcohol, followed by 8 c.c. of normal soda. The whole is well stirred, and after 2 hours filtered through a tared paper, and the precipitate washed, first with water, then with 75 per cent. alcohol, and dried at 100° C. and weighed. The precipitate = *Albumoses.* The filtrate and washings are evaporated, the residue dried at 100° C. and weighed. Its weight less 0·468 grm. to allow for the salt introduced during the analysis = *Peptones.* In case of samples containing much ash, it is well to let the acidified alcoholic solution stand for some time and to filter off any precipitate that appears, prior to addition of the normal alkali; and the weights of the separated albumoses and peptones should be verified and corrected by a determination of the nitrogen.—H. T. P.

Morphine, Determination of, in Opium. C. Montemartini and D. Trasciatti. Gaz. chim. ital. 1899, **29,** 292—300; through Analyst, 1899, **24,** [10], 264—265.

The authors' reply to the criticisms of H. Thoms and of K. Dieterich on their "sodium chloride" method of estimating morphine (Gaz. chim. ital. **27,** 302—335), and assert that their directions were inaccurately given in the German publication (Ber. deut. Pharm. Ges. **8**, 124, 171). They also describe a number of experiments, to prove that concordant results can readily be obtained, and in conclusion, give the following outline of their process with the modifications suggested by their recent work.

Ten grms. of the finely-powdered opium are dried at 100° C., and macerated with about 100 c.c. of a 20 per cent. solution of sodium chloride at intervals during an hour. The supernatant liquid is filtered off, and the mass again digested with about 60 c.c. of the same solvent, the process being repeated until the filtrate no longer reacts with Frohde's reagent. The combined extracts are evaporated to dryness on the water-bath, and the residue after being dried in the water-oven and finely pulverised, is extracted with boiling absolute alcohol, until no more morphine is removed. The residue left on evaporating the alcohol from this extract, is mixed with 15 c.c. of water, rendered slightly alkaline with ammonium hydroxide. The precipitate is washed on a weighed filter with cold water previously saturated with morphine, dried at 100° C., and weighed. It is then transferred to a stoppered funnel, and removed from the paper by washing with successive portions of chloroform or benzene, until on evaporating a few drops of the filtrate, and adding hydrochloric acid, and then sodium hydroxide, no turbidity is produced. Finally, the filter is again weighed after being dried at 100° C.—C. A. M.

Hydrastine Hexaiodide, and the Analysis of Hydrastis Canadensis, L. H. M. Gordin and A. B. Prescott. J. Amer. Chem. Soc. 1899, **21**, [9], 732—741.

When a solution of iodine in potassium iodide is added to a solution of a salt of hydrastine, a dense brown precipitate is obtained which approaches a tri-iodide in composition, but appears to be a mixture of different periodides.

If, however, a weak alkaloidal solution be added to a large excess of iodine, a definite compound, hydrastine hydriodide pentiodide, is precipitated as an amorphous brown powder. Ether, benzene, and cold chloroform only dissolve this with difficulty, but it is more soluble in hot chloroform and alcohol, and readily soluble in a mixture of alcohol and chloroform, or alcohol and ether. When heated in water it fuses to a resinous mass. The analysis of this periodide gave results corresponding with the formula, $C_{21}H_{21}NO_6.HI.I_5$, from which its iodine factor was calculated to be 0·60403.

The details of the authors' iodometric method of estimating hydrastine resemble those of their general method (this Journal, 1898, 612 and 1076; 1899, 526), and the only precaution to be observed is to insure the formation of the periodide by having the alkaloidal solution weak and the iodine in large excess.

In test experiments solutions were prepared containing 0·30 and 0·15 per cent. of hydrastine, and the amounts found by titration with iodine were 0·29 and 0·14 per cent. respectively.

The method which the authors have worked out for the assay of hydrastine and berberine in ***Hydrastis Canadensis, L.*** is based on the following facts:—(1.) Hydrastine is soluble in absolute ether, berberine completely insoluble. (2.) Berberine hydriodide is nearly insoluble, especially in the presence of a very large excess of potassium iodide. (3.) Berberine is completely precipitated on adding to a very dilute solution 10 to 15 times its volume of acetone, and then rendering the liquid strongly alkaline with sodium hydroxide. This berberine acetone is readily decomposed by mineral acids with the liberation of berberine.

In the assay 10 grms. of the root are rubbed to a paste with a few c.c. of a mixture of 5 c.c. of ammonium hydroxide ("stronger ammonia water"), 5 c.c. of alcohol, and 30 c.c. of ether. Chloroform, which was used in the author's general method of extracting alkaloids, cannot be employed here, since it combines with berberine, forming a compound not decomposed by acids. The paste is left in a stoppered jar overnight, is then exposed to a current of air, and, when all odour of ammonia has disappeared, is kept *in vacuo* over sulphuric acid for five or six hours. The dry powder is introduced into a Soxhlet apparatus, the jar being washed out with powdered glass or barium nitrate, and is extracted with 40 to 50 c.c. of ether, until a few drops of the extract give no reaction with Mayer's or Wagner's reagent.

The ethereal extract is transferred to a flat evaporating dish, and the flask washed out several times with water containing about 2 per cent. of sulphuric acid. The washings are added to the main solution, and the dish exposed in a current of air at about 30° C. until the ether has evaporated.

The liquid is then transferred to a 100 c.c. flask and made up to the mark, giving a solution of hydrastine sulphate, of which each 10 c.c. represents 1 grm. of the root. Of this filtered solution, 20 c.c. are run from a burette into a flask containing 20 to 30 c.c. of standard iodine solution (about 1 per cent.), and the amount of iodine consumed multiplied by 0·60403 gives the amount of hydrastine.

For a gravimetric estimation a second portion of 10 c.c. is shaken in a separating funnel with benzene and ammonium hydroxide. The colourless benzene layer, which contains the whole of the hydrastine is transferred to another separating funnel and shaken with water acidulated with sulphuric acid. Finally the hydrastine is extracted from this aqueous solution by means of ether and ammonium hydroxide, the solution allowed to evaporate in a weighed beaker in a dark place, and the residue dried *in vacuo* over sulphuric acid and weighed. The white crystals of hydrastine may have a slight yellow tint on the sides of the beaker. This the authors attribute to the presence of traces of canadine.

For the determination of the berberine the ether is removed from the Soxhlet extractor by means of a current of air, and the extraction continued with 40 to 50 c.c. of alcohol until the extract is no longer coloured.

The alcoholic solution of berberine and extractive matters is transferred to an evaporating dish which is kept on the boiling water-bath, whilst water is added from time to time until the alcohol has been evaporated. After the addition of a little more acetic acid, the dish is covered, and the contents when cold filtered into an Erlenmeyer flask.

From 6 to 8 c.c. of acetone are next introduced, followed by a 10 per cent. solution of sodium hydroxide, until the precipitate ceases to disappear on shaking, and the liquid becomes strongly alkaline.

After standing, the supernatant liquid is poured on to a small filter, and the crystalline berberine acetone washed until the washings are colourless. The precipitate is returned to the flask, and treated with dilute sulphuric acid to make up the volume to about 100—200 c.c., and the whole is boiled.

The liquid is now poured into a litre flask containing 100 c.c. of an N/20 solution of potassium iodide, made up to the mark, and 500 c.c. of the liquid are filtered off, and after the addition of 50 c.c. of N/20 silver nitrate and nitric acid, made up to a litre, and filtered. 500 c.c. of this filtrate are titrated back with N/40 ammonium thiocyanate, ferric ammonium sulphate ("ferric alum") being used as indicator.

Twice the number of c.c. of the thiocyanate solution used is equivalent to the number of c.c. of potassium iodide solution consumed by the berberine representing 10 grms. of the root. The amount of potassium iodide multiplied by the factor 0·167125, gives the percentage of anhydrous berberine in the root.—C. A. M.

Cinnamon Water, Examination of. Duyk. Ann. Chim. anal. appl. **4**, 223. Chem. Centr. 1899, **2**, [8], 455.

Aldehydes form insoluble hydrazones with phenylhydrazine, and the author uses this reaction for determining the amount of aldehydes in medicinal waters. The reagent used is a mixture of 1 grm. of phenylhydrazine hydrochloride, 1·5 grm. of potassium acetate, and 10 c.c. of water. 100 parts of cinnamic aldehyde correspond to 167 parts of the hydrazone. Mint-, rose-, orange-blossom-, and camomile waters do not react with phenylhydrazine. The amount of benzaldehyde in cherry-laurel water can be easily determined by this method. The presence of small quantities of alcohol do not injure the reaction.—A. S.

Gaseous Chloroform and Air in a Mixture of the Two; Methods for Determining the relative Proportions of, and on a Method for Producing a Mixture of Air and Chloroform in any Desired Proportion. A. V. Harcourt. Proc. Chem. Soc. **15**, [213], 188.

To produce anæsthesia, air is inhaled mixed with a small percentage of chloroform vapour. The proportion of chloroform most suitable for this purpose has not been determined, probably for want of a good chemical method of making this determination. The reaction which takes place between chloroform and a hot alcoholic solution of potash, $CHCl_3 + 4KOH = 3KCl + HCO_2K + 2H_2O$, seemed to furnish a basis for such a method. However, with regard to this reaction, two statements have been made: that all the chlorine of chloroform can thus be converted into a chloride, and that it cannot. The author has worked out and described a method for removing chloroform vapour from air, and obtaining chloride from it by means of the above reaction; but on applying the method to weighed quantities of chloroform, the results were always about 4 per cent. too low. This error is so nearly constant that the method may be used, and the results increased by 4 per cent.

A better method, depending on a reaction (which, as far as the author knows, is new), has since been worked out by him.

When the mixture of air and chloroform is mixed with a certain proportion of steam by heating it with a few c.c. of water to 50° or 60°, and a platinum wire is kept in a state of incandescence in this mixture, the whole of the chloroform undergoes the following change: $2CHCl_3 + 2H_2O + O_2 = 6HCl + 2CO_2$. With a fairly bright wire the change is complete in an hour, and the hydrogen chloride may be obtained in dilute solution by bringing in 20 c.c. of water, and may be determined in the flask with a standard solution of ammonia. If enough steam is not present, or the platinum wire is not heated beyond a low incandesence, or sufficient time is not allowed, a smell of chlorine will be observed at the mouth of the flask, and the result will be too low. It was ascertained incidentally that a weighed quantity of chlorine, treated as above, is completely converted into hydrogen chloride. Doubtless the changes $2H_2O + 2Cl_2 \rightleftarrows 4HCl + O_2$ both occur, but the water present gradually withdraws all hydrogen chloride from the system.

The author also described a method of producing a mixture of air and chloroform in any desired proportion and of constant composition. This consisted in blowing air through a mixture of chloroform and alcohol. The density of the liquid, showing the proportion of its ingredients, could be observed during the passage of the air by means of two little glass bulbs, of which one floated and one sank when the density was right, and be adjusted by additions of chloroform. Density and temperature being constant, the proportion of chloroform taken up by the air was constant also. To remove alcohol vapour, the current of air was then passed through two wash-bottles containing sulphuric acid and water respectively.

PATENT.

Milk, Milk Products, and other Fatty, Solid, or Liquid Matters; Process for Analysing, and Apparatus therefor. V. Durant, Brussels. Eng. Pat. 14,029, July 7, 1899.

The substance to be analysed is placed in a butyrometer tube with the usual reagents, and submitted to centrifugal treatment. The tube is then placed in a hot chamber until a certain temperature has been attained, and the volume of fat is read off in the graduated part of the tube.

The tubes are of two shapes, one being closed with a solid stopper, the opposite end of the tube being sealed up, and the other kind of tube being open at both ends and closed by stoppers. The stoppers are provided with rubber rings to ensure close fitting.

When butter is to be analysed, a "cup" stopper is used, in which the butter is weighed out and inserted into the butyrometer tube. Instead of measuring off the volume of fat separated, it may be allowed to cool and solidify in the tube. The acid liquors are then drawn off, the tube is dried by means of filter-paper, and weighed with the fat, the tube having originally been weighed.—W. P. S.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Barium, Strontium, and Calcium; Separation of, by Means of Mixed Sulphate and Carbonate Solutions of Varying Composition. F. W. Küster. 71st Meeting of the Soc. of German Scientists and Physicians, Munich, 1899; through Chem. Zeit. 1899, **23**, [80], 848.

The author considers the theory of the equilibrium of solubilities of the mixed precipitates as applied to this method of separation. He states that in a mixed saturated solution of two binary electrolytes with a common anion, the concentrations of the two other ions behave as the solubility of the products concerned, and equilibrium is adjusted to those relations. The ratio of barium sulphate to carbonate has been determined: $BaSO_4 : K_2CO_3 = 1 : 4$. Morgan, however, calculates that $1\,SO_4$ should suffice to compensate the action of $105CO_3$ on $BaSO_4$, which is 26 times as much as is found in practice. He starts from the solubilities of $BaSO_4$ and $BaCO_3$ as deduced from the electrical conductivities of their saturated solutions, assuming complete resolution into Ba'', SO_4'', and CO_3'', at such great dilutions. According to the author this is only correct for the sulphate, since most of the carbonate ions are hydrolysed into HCO_3' ions, making the solubility calculations on the CO_3'' basis erroneous. In fact, from the determined value 4, as against the calculated 105, it must be assumed that about $\frac{25}{26}$ of the carbonate is hydrolysed into HCO_3'. In the same way the calculated relationships of strontium sulphate and carbonate in equilibrium differ from the practical ratios. The ratio calculated from the conductivities is $1\,CO_3''$ to $60\,SO_4''$, but practically the relative concentration of the SO_4'' in the solution must be greater.—J. F. B.

Calcium Carbide as a Reducing Agent in Analysis in the Dry Way. M. Tarugi. Gaz. chim. ital. **29**, [1], 509—512; Chem. Centr. 1899, **2**, [10], 537.

Between CuO and dry calcium carbide a reaction commences at 432° C., and is complete at 1408° C., 5 grms. of carbide being necessary for each grm. of CuO. Copper-calcium alloys of varying composition are formed, which are decomposed, partially by water, completely by dilute hydrochloric acid; an alloy containing 1·27—1·5 per cent. of calcium oxide was found to be perfectly stable on exposure to the air. Similar results are obtained by using the different copper salts in place of the oxide. Lead salts and calcium carbide give lead-calcium alloys at 400° C.; with lead chromate and calcium carbide there is formed, besides the lead-calcium alloy, free chromium, which may easily be obtained pure. Salts of silver, gold, platinum, tin, bismuth, antimony, cadmium, zinc, nickel, and cobalt yield, under similar conditions, alloys of calcium with the corresponding metal; whilst salts of mercury and arsenic give the free metals. (See also this Journal, 1897, 145.)—A. S.

Copper Hypophosphite. R. Engel. Comptes Rend. **129**, [14], 518—520.

Copper sulphate is precipitated by barium hypophosphite, taking care that the former shall be in slight excess. To the filtered liquid is added a large excess of alcohol, and the crystalline precipitate which forms is washed with alcohol and dried in the air or over sulphuric acid. The hypophosphite has the formula $(PO_2.H_2)_2Cu$, is of a brilliant white colour, contains no water of crystallisation, and is soluble in water; the solid explodes with evolution of phosphine when heated to 90° C.; weak solutions, however, may be boiled without decomposition. Palladium, precipitated from its chloride by hypophosphorous acid, decomposes copper hypophosphite in the cold, with production of hydrogen, metallic copper (*not* copper hydride), and phosphorous acid. This is a so-called "contact action," the palladium undergoing no change. The decomposition of a strong solution of copper hypophosphite by heat takes place in a different manner, copper hydride, phosphorous and hypophosphorous acids being formed in the first instance, after which the copper hydride dissociates, and the precipitated copper slowly induces the oxidation of the hypophosphorous to phosphorous acid.

Precipitated palladium similarly reduces other salts of copper, of bismuth, and of antimony, with evolution of hydrogen. It also reduces salts of tin and lead, but in these cases there is no evolution of hydrogen, and the metal deposited on the palladium soon checks its activity.—J. T. D.

Quicksilver, Australian. J. Soc. Arts, 1899, **47**, [2449], 854.

The presence of native mercury or quicksilver in New South Wales was ascertained in 1841 by W. B. Clarke, who received a sample from a creek on the Cudgegong River, an auriferous stream, rising in the Australian Alps, and flowing through a portion of the western goldfields of the colony. In later years, cinnabar (sulphide of mercury) has been found in several districts, the richest deposits being near Yulgilbar, in the Clarence River district. The workings have been inspected by J. E. Carne, the mineralogist of the N.S.W. Department of Mines, who recommended the Government to give assistance to the prospectors. Six shafts have been put down on three parallel lodes, and samples of the ore obtained have been examined by the various Government departments. The assays indicate a yield of 3—5 per cent. of mercury, and the "spent ore" contains gold and silver. A further examination of the locality is being made by the Government geologist.—A. S.

Benzyl Alcohol, Preparation of, by the Interaction of Sodium Hydroxide and Benzaldehyde. C. A. Kohn and W. Trantom. Proc. Chem. Soc. **15**, [213], 194.

The object of the investigation was to ascertain if an intermediate compound was formed in the preparation of benzyl alcohol from benzaldehyde and soda. The authors state that, in presence of water, the sole products of the reaction are benzyl alcohol and sodium benzoate. By employing carefully dried materials, however, benzyl benzoate is formed to the extent of 10 per cent. The reactions which occur are explained by the following equations :—

(1) $2C_6H_5.CHO + NaOH = C_6H_5.C(ONa)(OH)(OC_7H_7)$;
(2) $C_6H_5.C(ONa)(OH)(OC_7H_7) = C_6H_5CO_2Na + C_7H_7OH$;
(3) $C_6H_5.C(ONa)(OH)(OC_7H_7) = C_6H_5.CO_2C_7H_7 + NaOH$.

Reaction (2) is favoured by the presence of water and excess of soda; reaction (3) by an excess of aldehyde.

Methylene Glucose : A New Glucoside. B. Tollens. Ber. 1899, **32**, [14], 2585—2588.

After many failures the author managed to isolate the above substance by allowing a mixture of 10 parts glucose, 10 parts of a 40 per cent. formaldehyde solution, 1 part concentrated hydrochloric acid, and 1 part glacial acetic acid, to remain for several months until a deposit of crystals had formed. After recrystallisation from water the purified substance had a composition corresponding to that of a mono-methylene glucose, $C_6H_{10}(CH_2)O_6 + \frac{1}{2}H_2O$.

The water of crystallisation is given off by heating at 100° C., and is not re-absorbed on exposure. Methylene glucose sinters at 179°—180° C. and melts at 187°—189° C. It is dextrorotatory with $[\alpha]_D = +9{\cdot}4^\circ$; its reducing power on Fehling's solution is a little more than half that of glucose; it yields an osazone, which is liquid at first, but subsequently crystallises, m.p. 164°—166° C.; it is practically unfermentable by beer yeast, and it gives the formaldehyde reaction with phloroglucinol and hydrochloric acid. The formula enunciated above was confirmed by methylene (formaldehyde) estimations and determinations of the molecular weight. All attempts to obtain combinations of formaldehyde with other glucoses and the like have hitherto been unsuccessful.—J. F. B.

Starch Solution, Preparation of; Reformation of Starch Granules from the Solution. H. Rodewald and A. Kattein. Sitzungsber. kgl. pr. Akad. Wiss. Berlin, **24**, 628—630; Chem. Centr. 1899, **2**, [8], 419.

If starch from wheat, potatoes, or rice be treated with a solution of iodine in potassium iodide, in the proportion of 15 parts of iodine and 200—300 of water to 100 parts of dry starch, and the mixture be heated in a sealed tube for 15 minutes at 130° C., a greenish-brown liquid is obtained consisting essentially of the excess of the iodine solution, a very small quantity of dissolved starch iodide and some sugar. The starch iodide can be completely separated from the iodine solution by dialysis, being obtained on the membrane as a deep blue solution, if sufficient water has been taken. The blue solution may be obtained clear by filtration. The amount of iodine, as determined by titration with sodium thiosulphate, was found to be constant at 14·3—14·85 per cent. of the dry substance. The blue solution, which contains about 2 per cent. of dry substance, decomposes when heated over the bare flame, with separation of free iodine, which can be completely removed by a current of steam. The starch solution remaining behind is clear, or, at the most, has a faint, turbid appearance. On gradually cooling this solution, a white substance separates, which, when examined under the microscope, shows the form of starch granules. The filtrate contains dissolved starch, and gives a deep coloration with iodine solution, whilst flocks separate on addition of potassium iodide. The starch granules separated on cooling, give the characteristic blue with iodine; when dried, are insoluble in cold water; but form a thick paste on boiling. With potash solution, the granules swell up and form a paste.—A. S.

Research in Connection with the British Pharmacopœia.

The following letter has been issued to working members of the British Pharmaceutical Conference, and to other pharmacists interested :—

Dear Sir,—It seems desirable that pharmacists should show in a practical manner their interest in the improvement of each successive Pharmacopœia, and thus prove their claim to a share in the production of that work.

Their interest might be made evident in an effective manner through the Pharmaceutical Conference, if those who are daily engaged in the manufacture of pharmacopœial preparations would keep a record of the difficulties met with, and of possible improvements in the preparations and in the tests for the purity of drugs.

It is generally recognised that the results obtained in operating upon large and small quantities vary within certain limits, so that records from wholesale druggists, pharmacists who make their own preparations, and hospital dispensers, would each possess a value of their own.

Such records, if summarised and presented each year in the form of papers to be read at the Pharmaceutical Conference, would not only form a valuable commentary on the Pharmacopœia, but would afford incontestable evidence that pharmacists are alive to their responsibilities and equal to the position they claim as co-workers with the medical profession in the production of the national Pharmacopœia.

I would therefore urge upon pharmacists generally, and upon the members of the Conference in particular, the importance of recording observations upon the practical working of the present Pharmacopœia. I should esteem it a favour if those who are willing to record such observations and present them in the form of papers to be read at the meeting of the Conference in London next year, 1900, would kindly intimate their intention to me or the honorary secretaries, at as early a date as possible.

I am, dear Sir, yours faithfully,
E. M. Holmes,
President of the British Pharmaceutical Conference.

(*See* this Journal, *under* XX., *page* 1048.)

New Books.

Die Aetherischen Oele. Von E. Gildemeister (Leipzig) und Fr. Hoffmann (New York). Bearbeitet im Auftrage der Firma Schimmel und Co. in Leipzig. Mit vier Karten und zahlreichen Abbildungen. Verlag von Julius Springer, Monbijouplatz 3, Berlin, N. 1899. Price M. 20.

This comprehensive work on the Ethereal Oils is contained in one large 8vo volume with preface, table of contents, nd 903 pages of subject-matter, followed by a page levoted to Errata, and 15 pages of alphabetical index. The text is divided into three principal groups. I. The Historical Introduction. II. The General Subject and Portion. III. The Special Subject. These are subdivided as follows:—I.—(1.) Spices and the Trade therein of the Ancients and in the Middle Ages. (2.) The History of the Ethereal Oils. (3.) History of the Methods and Utensils of the Distiller. II.—(1.) Theoretical considerations underlying the extraction of Ethereal Oils by Steam Distillation. (2.) The frequently occurring Constituents of the Ethereal Oils. (3.) The testing of the Ethereal Oils. (4.) Arrangement according to the Natural Families of those Plants from which the Ethereal Oils are obtained. III.—History, Origin, Extraction, Properties, Composition, Analysis, and Trade Statistics of the Ethereal Oils.

There are 82 wood engravings and several maps. Altogether some 422 Ethereal Oils are treated of in this work, and at the head of each chapter is given the name of the Essential Oil to be considered, in German, French, and English. Numerous references are given in the text to original works, treatises, and researches.

Die Verunreinigung der Gewässer, deren schädlichen Folgen, sowie die Reinigung von Trink- und Schmutzwasser. Mit dem Ehrenpreis Sr. Majestät des Königs Albert von Sachsen gekrönte Arbeit von Dr. J. König, Vorsteher der Agrikulturchemischen Versuchsstation in Münster i. W., &c. Zweite, vollständig umgearbeitete und vermehrte Auflage. Zwei Bände, I. und II. Verlag von Julius Springer, Monbijouplatz 3, Berlin, N. Price M. 26.

This work is comprised in two volumes, each to a certain extent complete in itself, and having its own alphabetical index and table of contents. His Majesty the King of Saxony offered a Special Prize for the best solution of the following questions:—(*a*) Demonstration of the Hygienic, Manufacturing, Industrial, Agricultural, and other Interests—including the Fishery Interests, which suffer injury in part by the use of the watercourses, and in part by the depositing therein of solid impurities, and the fouling of the running streams. (*b*) Precise specification and definition of the best chemical means, with details of machinery and plant involved, to be adopted to combat, prevent, or remove the different species of contamination, together with demonstrations of the technical and economic practicability of the proposals made. This work was unanimously awarded the prize by the judges, Profs. R. Virchow and P. Börner of Berlin, C. Pflügge of Breslau, Günther of Dresden, and G. Wolffhügel of Göttingen.

Practically Vol. I. of the work deals with question (*a*), and Vol. II. with question (*b*) just referred to. Vol. I. contains the table of contents, 440 pages of subject-matter, and the alphabetical index, the text being illustrated with 134 wood engravings; whilst Vol. II. contains table of contents, 500 pages of subject-matter, and the alphabetical index, with 20 wood engravings in the text.

Vol. I. deals with the following subjects, to go more into detail:—

Introduction.—I. The General Conditions and Relations involved in the Pollution of a Watercourse. II. Legal Enactments in force in different Provinces and Countries for Maintaining the Purity of River-Courses. III. The various Sources of Pollution of Water Supplies, &c. IV. Requirements in a Water for various Purposes.

Vol. II. Part I. Sewage with Predominating Organic and Nitrogenous Matters. Part II. Effluents with Predominating Inorganic Impurities.

Illustrated Syllabus of the Textile Industries Dyeing and Art Departments of the Yorkshire College, Leeds. Built, Equipped, and Endowed by the Worshipful Company of Clothworkers of the City of London. 1899. Price 1*s*.

Illustrated with 29 engravings, and containing a complete description of the various Departments and Courses, with an Historical Sketch.

The Manufacture of Carbons for Electric Lighting and other Purposes: a Practical Handbook giving a Complete Description of the Art of Making Carbons, Electrodes, &c.; the various Gas Generators and Furnaces used in Carbonising; with a Plan for a Model Factory. By Francis Jehl, Member of the American Inst. of Electrical Engineers, &c., &c. "The Electrician" Printing and Publishing Company, Ltd., Salisbury Court, Fleet Street, E.C. 1899. Price 10*s*. 6*d*.

Contains preface, table of contents, and 219 pages of subject-matter, illustrated with 83 wood engravings, and an alphabetical index. I. and II. Physical Properties of, and Historical Notes on Carbon. III. Facts concerning Carbon. IV. Modern Process of Manufacturing Carbons. V. Hints to Carbon Manufacturers and Electric Light Engineers. VI. A "New" Raw Material. VII. Gas Generators. VIII. The Furnace. IX. Estimation of High Temperatures. X. Gas Analysis. XI. Capital, &c. necessary for Starting a Carbon Works, and the Profits in Carbon Making. XII. Manufacture of Electrodes on a Small Scale. XIII. Building a Carbon Factory. XIV. Soot or Lamp Black. XV. Soot Factories. Appendix.—American Method of Carbon Manufacture.

The Rise and Development of the Liquefaction of Gases. By Willet L. Hardin, Ph.D., Harrison Senior Fellow in Chemistry in the University of Pennsylvania. The Macmillan Company, New York. Macmillan and Co., Ltd., London. 1899. Price 6*s*.

Small 8vo volume, containing preface, table of contents, and 244 pages of subject-matter, with indexes of authors and subject-matter. The text is illustrated with 42 woodcuts, and treats of the following subjects:—I. The term "Gas," &c. II. Liquefaction of Gases by Faraday and others. III. Andrews' Experiments on Carbonic Acid, &c. IV. Liquefaction of so-called Permanent Gases by Cailletet and Pictet, &c. History of Regenerative Method of Refrigeration, and Application of this Method to the Liquefaction of Oxygen, Air, Nitrogen, &c., by Linde, Hampson, Dewar, and Tripler. Liquefaction of Hydrogen and Helium. The three States of Matter. Industrial Application of Liquefied Gases, &c.

The Chemistry of Soils and Fertilizers. By Hy. Snyder, Professor of Agricultural Chemistry, University of Minnesota, &c. Chemical Publishing Co., Easton, Pa., U.S.A. 1899. Price 1·50 dol.

This work embodies a course of lectures given in the University of Minnesota. It contains preface, table of contents, and text, filling 272 pages. An alphabetical index closes the volume. The following are the leading subjects and themes:—I. Physical Properties of Soils. II. Geological Formation and Classification of Soils. III. Chemical Composition of Soils. IV. Nitrogen of the Soil and Air; Nitrification and Nitrogenous Manures. V. Fixation. VI. Farm Manures. VII. Phosphate Fertilizers. VIII. Potash Fertilizers. IX. Lime and Miscellaneous Fertilizers. X. Commercial Fertilizers. XI. Food Requirements of Crops. XII. Rotation of Crops.

Handbook of Practical Hygiene. By D. H. Bergey, A.M., M.D., University of Pennsylvania. Chemical Publishing Co., Easton, Pa., U.S.A. 1899. Price 1·50 dol.

8vo volume, containing preface, table of contents, and 156 pages of subject-matter, followed by an alphabetical index. The subject is subdivided as to treatment into five chapters, devoted as follows:—I. Introduction. II. Water. III. Soil. IV. Sanitary Analysis of Foods. V. Ventilation and Heating.

La Chimica Industriale Revista Tecnica, Industriale e Commerciale. Publicata per cura. Dell' Associazione Industriale.

An Italian Society of Chemical Industry has just been founded in Turin, and this, the first issue of its Journal, has the above title. The President of the new Society is Cav. Ing. V. Sclopis, and the Secretary, Ing. A. Re. The office of the new Society is in Via Mazzini. 2, Turin, Italy.

Trade Report.

BOARD OF TRADE NOTICE.

(*Handbill* 181. *September*, 1899.)

Bisulphide of Carbon, Carriage of, on board Ship.

The Board of Trade are advised that bisulphide of carbon comes within the definition of "Dangerous Goods," and it should therefore be distinctly marked and otherwise dealt with as required by Section 446 of the Merchant Shipping Act, 1894.

Bisulphide of carbon should be carried in strongly made and perfectly tight drums of not more than five gallons capacity each. The drums should be satisfactorily tested by hydraulic pressure to at least 40 lb. per square inch before being used, and a space of at least 10 per cent. should be left in each to allow for expansion of the liquid. Drums of the kind employed by the Government of India for the shipment of ether are recommended for this purpose.

The drums should be packed in strong wooden cases (which should be perforated) with not more than four drums in each case, each drum being in a separate compartment of the case.

It should be carried as deck cargo only, the utmost care being taken to protect it from the rays of the sun, or lights, or sparks; sail cloth (not black tarpaulin) is suggested as a covering. It should be stowed apart from all other goods, whether dangerous or not, and kept at a distance from all steam pipes, funnels, or other heated objects, and from all hatchways or other openings in the deck; also from all living quarters of the vessel; and smoking in its vicinity should be strictly prohibited.

The cases containing the drums should be examined at frequent intervals (at least twice in 24 hours), during daylight, to ascertain if there is any escape; and if any leakage is detected, even by the presence of the odour above described in the vicinity of the packages, they should be immediately thrown overboard; and it is important that the person making these examinations should know that leakages sufficiently large to be very dangerous may exist without its being possible to see anything in the nature of moisture on the outside of the drums to indicate their presence.

Handbill No. 176 is withdrawn.

Courtenay Boyle,
Secretary.
Walter J. Howell,
Assistant Secretary.

OFFICIAL REPORTS.

The Chlorate Explosion at St. Helens.

Chem. Trade J., Nov. 11, 1899, 315.

The Home Office Report on the great explosion that occurred at the Kurtz Chemical Works at St. Helens on the 12th of May last was issued on November 9th. Colonel A. Ford, C.B., Her Majesty's Chief Inspector of Explosives, was deputed by the Home Office to make the investigation, and he was assisted by Dr. Dupré, F.R.S. Colonel Ford goes at length into the effects of the disaster, and says, so far as he can ascertain, an "explosion" of potassium chlorate has hitherto been unknown either in England or in any other country. Among the explanations suggested are the following:—That the smoke from burning wood may have formed an explosive mixture with the oxygen liberated by the heat from the chlorate, that the charred wood may have formed an expolosive mixture with the free oxygen from the chlorate, that the fused chlorate may have sunk into the alkali waste heap on which the store was erected and formed an explosive mixture with the sulphide of lime or sulphur contained in it, although this theory was negatived by the absence of certain well-defined appearances, and that the temperature of the burning store may have reached the point when the chlorate would be suddenly decomposed with the evolution of an enormous volume of oxygen gas. Colonel Ford goes on to relate the character of experiments made to attempt to explode potassium chlorate, and says these experiments failed to produce an "explosion." Neither were detonating experiments any more successful, but it was demonstrated that the potassium chlorate could be exploded by very sudden application of great heat, and in view of this result it cannot be doubted that an explosion of a small portion of the chlorate actually did occur. This portion was doubtless raised very rapidly to the required temperature by the intense heat caused by the burning of some kegs in contact with other portions of the chlorate. Accepting that view, Colonel Ford goes on to suggest means of preventing a similar disaster.

Suggestions for Safety.

It is obvious, he says, that if the kegs, the re-crystallising tanks, and the buildings had been made of uninflammable materials this disaster could not have happened. All inflammable materials, therefore, as well as those liable to form an explosive mixture with the chlorate, should be rigidly excluded from the packages containing the chlorate and the tanks and buildings in which this portion of the manufacture is carried on. As to the blame to be attached the Inspector says: Having regard to the fact that potassium chlorate has hitherto been held to be not liable to explode under any condition, and that, although it was well known that a great conflagration at the works might be the result of an accidental ignition, a worse disaster could not have been foreseen. I do not think that any blame in respect of this explosion can be justly attached to the United Alkali Company, Limited, the proprietors, to the manager, or anyone connected with the works. I have no doubt that they will take the necessary precautions to prevent a recurrence of the disaster by adopting the use of uninflammable materials as suggested. Colonel Ford, in conclusion, agrees in the main with the recommendations of the coroner's jury, and testifies to the great assistance rendered by Dr. Dupré, the town clerk, the chief constable, the borough engineer, and the United Alkali officials.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

New Customs Tariff of Newfoundland.

Bd. of Trade J., Nov. 1899, 572.

The Board of Trade have received from the Government of Newfoundland copy of resolutions containing alterations in the Revenue Act, according to which duties on certain goods imported into Newfoundland are now levied as follows:—

Articles.	Duty.
Aerated waters of all descriptions and non-alcoholic drinks (N.E.S.) not to include natural mineral waters.	35 per cent. *ad val.*
Spirits and strong waters of any kind mixed with any ingredient or ingredients not being known or designated as anodynes, elixirs, essences, extracts, lotions, tinctures or medicines, or medical wines (so-called), and ethereal and spirituous fruit essence (N.E.S.).	30 per cent. *ad val.*
Patent and proprietary preparations, tinctures, pills, powders, troches, lozenges, syrups, cordials, bitters, anodynes, tonics, plasters, liniments, salves, ointments, pastes, drops, waters, essences, and oils (N.E.S.).	30 per cent. *ad val.*
All medicinal preparations containing over 30 per cent. of alcohol.	50 per cent. *ad val.*
Soda, caustic, potash, and lye........................	50 per cent. *ad val.*

Belgium.

Rebate of Excise Duty on Alcohol used in certain Industries.

The *Moniteur Belge* contains copy of a decree granting a total rebate of the excise duty on alcohol used in the manufacture of sulphuric ether or artificial silk.

NETHERLANDS.

Tariff Modifications.

According to a Royal Order in the Dutch Official Gazette of 22nd August last, collodion required in the preparation of incandescent light mantles is exempted from import dues on entry into the Netherlands. The above order has been issued subject to certain regulations as to quantity admitted, destination, &c., so as to guard against abuse of the privilege.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

DRUG AND CHEMICAL TRADE OF ALEPPO.

Chem. and Druggist, Nov. 11, 1899, 810.

A French consular report on the trade of Aleppo during 1898 states that there was a substantial decrease in the importation of drugs and chemicals, Great Britain supplied the bulk of the acids and patent medicines. France furnished sulphuric acid and boric acid; Italy citric and tartaric acids; Germany, aniline salts and magnesia salts. The entire value of the chemical importations were 120,000fl. (1fl. = 1*s*. 8*d*.), and drugs 70,000fl. The export of Aleppo galls was less than one-third of a normal year, and amounted to 200,000fl, the bulk of which went to Germany and Great Britain. About 300 tons of olive oil was shipped, valued at 100,000fl., of which about three-quarters went to Turkish ports and Egypt, and the remainder to Europe.

MINING INDUSTRY IN SWEDEN.

Bd. of Trade J., Nov. 1899, 552.

The following report on the mining industry of Sweden for 1898, based on statistics issued by the Swedish Board of Trade, has been received from Her Majesty's Consul at Stockholm.

The total value of mining products in 1898 was about the same as in 1897, amounting to the very considerable sum of 151,980,000 kronor (8,433,333*l*.) in 1898, against 151,710,000 kronor (8,428,333*l*.) in the preceding year.

The following table shows the production in 1898 as compared with the previous year, together with the increase and decrease of the various minerals and the value of the quantities obtained:—

Minerals.	Production in 1898.	Difference compared with 1897.	Value in 1898.
	Tons.	Tons.	£
Iron ore	2,302,546	+ 216,427	611,108
Gold ore	2,136	+ 474	1,350
Siver and lead ore	6,743	− 3,325	11,035
Copper ore	23,335	− 1,872	20,524
Zinc ore	61,627	+ 4,991	124,207
Manganese ore	2,358	− 391	2,293
Iron pyrites	386	− 131	213

Other ores than iron have been obtained to the value of 2,870,000 kronor (159,444*l*.), against 2,130,000 kronor (118,333*l*.) in 1897, the increased value being chiefly due to larger production of zinc.

Coal, fire-proof clay, and feldspar amounted to :—

——	1897.		1898.	
	Kronor.	£	Kronor.	£
Coal	1,610,000	84,444	1,730,000	96,111
Fireclay	180,000	10,000	210,000	11,666
Feldspar	200,000	11,111	240,000	13,333

Other metals than iron were obtained to the value of 3,600,000 kronor (200,000*l*.). The production of gold and lead has increased, but that of silver and copper has diminished.

GUNPOWDER AND OTHER EXPLOSIVES IMPORTED INTO BRITISH POSSESSIONS, &c.

Bd. of Trade J., Nov. 1899, 574.

The following statement, showing the quantities and values of gunpowder and other explosives imported into the under-mentioned British Possessions in the year 1898, has been prepared by the Commercial Department of the Board of Trade from official statistics :—

——		Quantities.	Values.
			£
Straits Settlements[*] :—			
Dynamite	Cases	3,853	13,458
Gunpowder	Pikuls[†]	539	2,229
India[‡] :—			Rx.
Gunpowder, common	Lb.	181,275	6,442
Dynamite and all other explosives.	Cwt.	11,428	127,127
New South Wales :—			£
Powder (blasting)	Lb.	951,775	20,029
Fuse	Packages	1,405	13,855
Dynamite and lithofracteur.	Lb.	1,009,296	74,372
Other explosives	Packages	424	4,275
Victoria :—			
Detonators	"	402	4,779
Dynamite	Lb.	28,851	2,493
Fuse	Coils.	78,222	2,121
Gelatine (blasting)	Lb.	129,850	12,187
Gelatine, dynamite, and gelignite.	"	767,410	59,103
Guncotton	"	250	15
Powder (blasting), common.	"	334,000	5,437
South Australia (including Northern territory) :—			
Detonators	..	..	1,498
Fuse	..	..	2,631
Blasting	Lb.	99,000	10,345
Dynamite	"	78,000	6,700[‖]
Gelatine, dynamite, and gelignite,	"	214,000	17,274
Powder (blasting)	"	308,225	7,279
Western Australia :—			
Blasting gelatine	..	..	11,032
Detonaters	..	..	2,803
Dynamite	..	..	4,360
Dynamite gelatine	..	..	18,253
Fuse	..	..	6,992
Gelignite	..	..	33,184
Powder (blasting)	..	..	3,736
Rackarock	..	..	2,282
New Zealand :—			
Detonators for dynamite	No.	1,571,990	3,108
Dynamite	Lb.	139,100	11,277
Fuse	Coils	158,726	4,818
Powder (blasting)	Lb.	334,000	7,506
Other explosives	"	250,960	19,040
British Columbia (year ended 30th June, 1898) :—			
Gun, rifle, and sporting powder.	"	5,927	404
Blasting and mining powder.	"	200	6
Giant powder, nitro, and other explosives.	"	10,560	334
Queensland :—			
Cartridges, sporting and blasting.	Packages	912	5,995
Detonators	"	211	2,379
Dynamite	Lb.	149,050	9,822
Dynamite (gelatin)	"	95,000	7,030
Fuse	Packages	814	6,355
Gelignite	Lb.	417,745	31,881
Rackarock	"	20,612	1,505
Roburite	"	250	15
Powder, blasting	"	55,470	1,319
Other explosives	"	27,500	2,175
Cape of Good Hope :—			
Gunpowder, including powder contained in cartridges.	"	115,447	9,765
Dynamite and blasting compound and powder.	"	2,509,060	115,989
Detonators and fuse	..	..	26,196
Guncotton	Lb.	668,341	59,018

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[*] Exclusive of the trade between the Settlements.

[†] Pikul = 133⅓ lb.

[‡] Imports on private account only, and for the 12 months ended 31st March, 1899.

[‖] Including 777*l*., the quantity for which is not stated.

The Mining Industry of Greece.

Eng. and Mining J.; through Bd. of Trade J., Nov. 1899, 560.

The production was as follows :—

—	1897.	1898.
	Tons.	Tons.
Iron ore	260,828	287,100
Manganiferous iron ore	182,850	213,938
Manganese	11,868	14,097
Zinc blend	3,118	1,139
Calamine, roasted	22,817	30,906
Chrome ore	563	1,367
Magnesite, raw	11,311	14,829
Magnesite, calcined	686	129
Magnesite, bricks	826	516
Emery	3,024	2,932
Salt	20,421	25,250
Lignite	20,018	17,300
Pozzolana earth	42,600	70,700
Lead dust	2,785	2,655
Argentiferous lead	15,946	18,888
Commercial lead	520	305
Graphite	2,815	..

Establishment of a German Council for Industrial Affairs.

Bd. of Trade J., Nov. 1899, 598.

A memorandum by the Commercial Attaché to Her Majesty's Embassy at Berlin, states that the general meeting of the "Society of Industrialists" (*Bund der Industriellen*) has recently decided to establish a German Council for Industrial Affairs (*Industrierath*) somewhat similar to the "German Council for Agricultural Affairs" (*Landwirtschaftsrath*). The former is to be an assembly representative of industrial interests in the same way as the latter is of agricultural interests. The following is the plan for the creation of this new Council.

1. The object of the "Industrial Council" is to look after the common interests of all industries in the German Empire, both economic and "social-political," in all matters before the Government, before the Reichstag, and before the public.

2. The "Industrial Council" consists of men drawn from the three principal groups of German industry, *viz.* : from the "Central Society of German Industrialists" (*Centralverband deutscher Industrieller*), from the "Society for the Protection of the Chemical Interests" (*Verein zur Wahrung der Interessen der chemischen Industrie*), and from the "Society of Industrialists" (*Bund der Industriellen*). Each of these three groups nominates 12 deputies to the Council, who will elect from among themselves a directorate and a working committee.

3. In order to avoid disputes, a unanimous decision is to be arrived at that each group has absolutely equal rights in the Council.

4. The members of the three groups, forming this Council, or the societies attached to them, can submit to the directorate of each group questions to go before the Council. In order that only well-considered questions may come before the Council, it is provided that matters can only be sent into it by the directorates of the three groups. The Council can deliberate upon any subject thus brought before them ; but it is bound to do so if the matter to be brought before them is backed by a third of the members of the "Industrial Council."

It is also provided that industrialists or industrial societies, who do not form part of the three above-mentioned groups, may bring questions before the Council, if one of the three directorates approves.

Patent Medicines in Portugal.

Bd. of Trade J., Nov. 1899, 567.

The United States Minister at Lisbon, in a recent report, gives the revised regulations for granting licences in Portugal for the sale of medicines of secret composition.

The following are some of the regulations in question.

Article I.—Any person desiring a licence for the sale of a patent medicine, must apply either in person or through the medium of an attorney to the Minister of the Interior, giving a circumstantial statement of the effect and utility of the medicine, together with a sample of the same, accompanied by the formula for its preparation, signed and sealed by the applicant or his attorney, and by an acknowledgment of the deposit of 75 milreis (17*l.* 1*s.*) in the public treasury.

Article II.—These requirements having been complied with, a member of the consulting board of health shall be appointed to inspect and test the aforesaid medicine, and the formula for its preparation.

Article IX.—The stipulations laid down in the preceding articles are applicable to the importers of those patent medicines which have not yet been included in the list of medicines as dutiable, with this difference, that the licence shall not be personal, but granted for the medicine.

Article X.—Patent medicines which have obtained the approval of various foreign academies of medicine, authenticated by the Portuguese Chargés d'Affaires in the different countries, may with the approval of the Board of Health, be admitted into the Kingdom by complying with the formalities of Article I.

Sulphur Trade of Sicily.

Bd. of Trade J., Nov. 1899, 603.

Her Majesty's Consul at Palermo reports that the exports of sulphur from Sicily up to 30th September of the current year were, as compared with the previous year, as follows :—

	Tons.
Exports from 1st Jan. to 30th Sept. 1899	384,532
" " " 1898	372,899
Increase for current year	11,633

Taking a complete twelvemonth, the exports were as follows :—

	Tons.
1st October 1898 to 30th September 1899	479,474
" 1897 " " 1898	454,659
Increase for present year	24,815

Sumach Trade of Sicily.

Bd. of Trade J., Nov. 1899, 603.

Her Majesty's Consul at Palermo states that the operation of the two first months of the new Sicilian Sumach Ring have not been very promising. This result is chiefly due to the high prices demanded for this commodity. Sicilian grinders have full stores of the new crop ; extra storage has also been requisitioned. Very little, scarcely any, sumach has gone to the United Kingdom.

Extensive sumach cultivation has been started in Cyprus. If the Cyprus sumach should succeed, and be kept free from the Sicilian Ring, it will be a serious factor to consider in the market.

Some parcels of Cyprus sumach shipped to the United Kingdom were found to "spot" the skins in which it was used. This defect was attributed by English tanners to imperfect ventilation or milling.

In Marseilles, where another parcel was shipped, the French tanners came to the conclusion that the spotting might be due to the presence of iron in the soil on which the Cyprus sumach was raised.

On the other hand, in the early days of the Sicilian trade, it was found that sumach had to be carefully stowed on board iron vessels in order to keep it free from all other freight which might cause damp vapours or a dropping of rust on the sumach, as this caused spotting.

Tartaric Materials Exported from Italy in 1898–99.

Bd. of Trade J., Nov. 1899, 602.

The following statement, showing the quantities and value of tartaric material exported from Italy in the 12 months ended 30th September, 1899, has been received at the Board of Trade through the Foreign Office:—

Quality.	Exported to	Quantity.	Value.
		Tons.	£
Half refined tartar.	United States....	6·5	74,550
	Great Britain....	311·5	
	Germany	421·5	
	France	162·0	
	Other countries..	423·5	
Vinaccia argols	United States....	759·0	138,600
	Great Britain....	1,350·0	
	Other countries..	582·0	
Crude argols.......	United States....	1,394·0	78,300
	Great Britain....	140·0	
	Germany	150·0	
	Other countries..	180·0	
Winelees	Great Britain	744·0	29,450
	Germany	300·0	
	France	96·0	
	Other countries..	1,315·0	

New Process for Manufacturing Opalescent Glass.

Bd. of Trade J., Nov. 1899, 597.

A proprietor of glass works at Buchenau in Bavaria has lately discovered a way to make opalescent glass which is said to be equal to that made by Tiffany, of New York. It is hoped that this glass will successfully compete with the American product, which previous imitations have not succeeded in doing.

GENERAL TRADE NOTES.

Pasteboard Roofing Shingles in Japan.

Bd. of Trade J., Nov. 1899, 618.

The *Japanese Times* states that the Tokyo Card and Pasteboard Co. is now making a thick tarred pasteboard as a substitute for shingles in roofing. The paper shingles are about 50 per cent. cheaper and more easily managed than the wooden article. The *Indian Textile Journal*, commenting on the above, says that it is doubtful if Japan is as well off for vegetable fibrous materials as India, but Japan is enormously in advance of India in the knowledge of papermaking and in utilising its natural resources. What is required for the production of cardboard is a supply of coarse fibre and a cement to hold it together. India lacks neither of these, although they have not yet received sufficient attention. Waste sugar cane produces a fibre eminently suited for cardboard making, and the contained sugar is an ingredient that could be fixed chemically as a cement. The milk of the cactus, so common among railway fences, contains a gum that has been used for closing letters. An antiseptic would be required to arrest fermentation in many fibres; but the substances used in size preparation are well known and easily procurable in India. The tarred cardboard would not suit India on account of its disposition to heat in the sun and soften. It would also require to be prepared with pitch of very high melting point to stand even the shade temperature. A paper roof would be far superior to sheet iron as a protection against the sun.

Palladium in South Australia.

Chem. and Druggist, Nov. 4, 1899, 735.

A discovery of palladium is advised from South Australia. According to the report, samples of stone from surface outcrops near Mount Torrens were being assayed for gold at the Government battery, when the assayer found another metal present. After careful testing he ascertained it to be palladium, the yield being 17 oz. 6 dwt. 11 gr., with 16 dwt. 21 gr. gold to the ton. The value is about 112*l.* per lb.

Aluminium Goods in India, The Manufacture of.

Bd. of Trade J., Nov. 1899, 609.

Prof. Chatterton, of the College of Engineering and the School of Arts, Madras, writes to the *Madras Mail* stating that the manufacture of domestic utensils of aluminium is making a great stride in India. The work was originally started at the School of Arts, but there are now several other centres of manufacture, and the more general adoption of the metal is being hastened by the prevailing high prices of copper and tin. A large order for cooking vessels for the 28th Madras Infantry has recently been filled at the school. These vessels have almost of necessity to be made by hand, since each native regiment has its own patterns. The production of a suitable water bottle is, however, a difficulty, as the flat pattern is not easily made in aluminium since soldering cannot be used; while a cylindrical pattern cannot be conveniently carried. Aluminium has also recently been used as a bearing metal for shafting in the Madras College of Engineering and has proved satisfactory.

Semet-Solvay By-product Coke Ovens in England.

Eng. and Mining J., Oct. 7, 1899, 424.

The London *Colliery Guardian* gives the following as the net return from 100 tons of English coal treated in Semet-Solvay by-product ovens:—70 tons of coke at 14*s.* a ton (less cost of raw coal, 4*s.* 9*d.* a ton, and labour, stores, &c., 2*s.* 9*d.* a ton), 15*l.* 12*s.* 6*d.*; steam raised (equivalent to that produced by 13 tons of coal at 3*s.* 6*d.*), 2*l.* 5*s.* 6*d.*; tar, 4·75 tons at 20*s.*, 4*l.* 15*s.*; sulphate of ammonia, 1·25 tons at 7*l.* 15*s.* (less 3*l.* for acid, labour, &c.), 9*l.* 13*s.* 9*d.*; light oil, 303 galls., at 5*d.* (less labour, chemicals, &c.), 4*l.* 16*s.* 3*d.*; total return, 37*l.* 3*s.* Nothing has been allowed for establishment charges or for depreciation. The finished benzols have been calculated in the terms of light oil for the sake of convenience, and the figures are from actual practice. The net revenue per oven per annum, in by-products at present prices, is, therefore, 1,750 tons at 19*l.* 5*s.* per 100 tons, or a net return of about 50 per cent. on the recovery or chemical portion of the plant; that is, on the sum spent to recover the by-products.

Arsenic-making at Deloro, Ontario.

Eng. and Mining J., Oct. 21, 1899.

The new plant of the Canadian Goldfields, Ltd., at Deloro, Ontario, lately started refining arsenic. The plant is situated in the old original mill, which is a very large building, and which contained the machinery for the purpose used some years ago. However, a great deal of remodelling had to be done and many improvements added. It consists of several furnaces, a large number of closed chambers, engine, packing-room, store-room, bath-room, &c. The concentrates are run through elevators until they are brought into a large slowly-revolving furnace, which drives off the sulphur and arsenic in vapours. These pass through large brick chambers and the arsenic gradually condenses and drops. These chambers are then emptied and the contents passed through another similar cylinder and series of chambers. It is then dried and packed for shipping. From both series of furnaces, roasting cylinders and chambers, large flues, which join in the form of a Y, run to a high smoke-stack. No arsenic escapes, so that there will be no danger to surrounding fields. The finished product is sold in New York, where there is a good demand for it.

Trade of Seychelles.

Chem. and Druggist, Nov. 14, 1899, 735.

The Government trade returns for 1898 have just been published, showing that the total imports into the colony were valued at 1,009,681 r., and the exports at 1,381,514 r. Although neither of these totals equal those of 1897 (a record year), they must be considered very satisfactory if the returns of only a few years ago are considered. The value of the drugs imported was as follows:—

From England.........	38 cases,	valued at	2,265 r.
„ France..........	82 „	„	2,968 r.
„ Mauritius.......	21 „	„	334 r.
„ India...........	14 „	„	682 r.

Caustic soda for soap-making was imported from England *viâ* Mauritius to the extent of 8,400 kilos., valued at 847 r. Amongst the exports, vanilla, of course, is the most important. Cocoanut oil was exported to the extent of 13,208 hectolitres, valued at 354,430 r., and soap (to Madagascar and East Coast of Africa), 189,645 kilos., valued at 56,923 r.

INDIGO, NATURAL *v.* SYNTHETIC.

Chem. Trade J., Oct. 28, 1899, 286.

Messrs. Mewburn and Ellis tabulate the position and effect of synthetic indigo on the manufacture of natural indigo, as follows :—

1. That there will not be much cutting of prices for some few years.

2. That the cost of making synthetic indigo will run the same course as other coal-tar dyes, *viz.*, the cost of manuture will gradually decrease.

3. That the cost of making indigo in India will not decrease in the same proportion.

4. That dyers prefer synthetic indigo, being able to rely on its strength.

5. That eventually synthetic indigo will have a very serious effect on the natural indigo trade.

These statements have elicited the following criticism in favour of natural indigo from E. C. Schrottky, who says :—

The indigo industry in India has up to the last few years occupied an anomalous position. Cultivation and manufacture have remained practically the same as they were at the end of the last century. Indigo planters have rallied together in face of competition, are now employing distinguished chemists, and are taking practical steps to improve their methods of cultivation and manufacture. The financial-agency houses are establishing experimental factories where improvements in manufacture and cultivation can be worked out and tested. Only about one-third of the dye in the plant is obtained by the ordinary methods of manufacture, and, moreover, waste to the extent of 20 per cent. of the ultimate outturn occurs therein. There is, therefore, an ample margin for improvement in the manufacture alone, besides the progress which can be made by improved methods of cultivation and drainage, and the use of new and selected seed. The chemistry of indigo manufacture is still somewhat obscure; the dye in the plant is not present in a merely extractable state, like theine in tea leaves, but has to be developed from certain basic products, which is most profitably done by a prolonged fermentation of the plant, the agency being then microscopic life. One of the leading agency houses is already fitting out one of their factories in Behar to test, next season, a new process for which an outturn of more than double the quantity of dye is claimed.

Prof. H. E. Armstrong, writing to the *Times* (see also J. Soc. Arts, Nov. 3rd, 1899, 891), says :—"It is no question of introducing a substitute for 'real indigo,' if by this is meant the blue colouring matter in commercial indigo, but of using an article differing only from that produced in India (apart from the presence of indigo red in the latter) by its freedom from the foreign matters often present in commercial natural indigo. Unless these impurities play an important part in the dyeing process—and this is improbable —the artificial product should be at least as good a dye in all respects as the natural indigo.

"Indigo, properly speaking, is not a dyestuff, but an insoluble pigment. To dye with it, the blue must first be converted into soluble indigo white. It is said that the artificial substance is not quite so easily reduced to white as is the natural product; but this involves no real distinction. Crystalline substances are often less amenable to treatment than are amorphous ones, and probably little difficulty will be experienced in making artificial indigo just as easy to treat as that from any natural source.

"Messrs. Mewburn and Ellis have by no means exaggerated the danger ahead.

"No reliance can be placed on a rise in price of crude materials. There should be no difficulty in increasing the production of naphthalene and toluene, should a demand arise; enormous quantities of tar are now allowed to go to waste in coking coal.

"The stake for which the German chemical manufacturer is playing is a very big one—far bigger than was offered by madder 30 years ago. Indigo is more difficult to make than is alizarin, but such is the persistence of the German attack upon the position, and so great is the improvement in our methods, that it is far from improbable that all difficulties will ere long be overcome.

"The one lesson to be learnt is, that planters should without delay seek to improve the cultivation of the plant and the extraction of the indigo from it. It would be interesting to know whether a single competent chemist is at present engaged in studying the subject, and whether the Indian Government has in any way had its attention directed to the importance of scientific aid being given to the industry."

ALKALI DEPOSITS IN WYOMING.

Eng. and Mining J., Nov. 11, 1899, 543.

In 1895 the Green River Fuel and Oil Company, of Green River—a division point on the Union Pacific Railroad, 800 miles west of Omaha—in drilling a well for either gas or oil, encountered an alkaline water which caused a stoppage of operations. Some months later this water was analysed, proving it to be charged with a high percentage of sodium carbonate, instead of sodium sulphate, as is generally the case in alkaline waters in the West. The importance of this discovery was not appreciated by the owners of the property, neither did they possess the means to take advantage of this freak of nature. Later, numerous analyses of the water were made, all of which show a remarkable uniformity—in fact, there appears to be no variation in any particular in the four years the well has been flowing, except as the temperature of the water has changed with the seasons. Except sodium chloride there are only traces of other solids to be found in the water. The lesser solubility of salt compared with sodium carbonate admits of its precipitation cheaply, and the subsequent recovery of the sodium carbonate may be obtained at a cost of possibly not to exceed 1 dol. per ton, for a dry product that will show 60 per cent. actual alkali.

A recent analysis, or test, of the water, by Herman Harms, of Salt Lake city, in no essential differs from others made in past four years, and shows :—Colour of water, bluish tint; odour, very slight; clearness, bright; sediment, very slight; gravity, 13·5 per cent. at 59° F., corresponding to 25·43 per cent. solids—crystallized carbonate.

One litre contains a crystallized sodium carbonate, 246·20 grm.; of sodium chloride, 6·12 grm., and traces of sulphate of lime and potash. Practically speaking, 1 gall. of this water contains 2·05 lb. crystallized sodium carbonate and 0·05 lb. sodium chloride.

This unique flow of alkaline water has not yet been turned to a commercial proposition, though plans to that end are now being formed. Its economic proportion can be readily appreciated by any well-informed industrial chemist. Coal for steam or evaporating purposes is to be had from Rock Springs—15 miles distant—for 75 cents per ton, delivered at Green River. Lime rock, necessary in the production of caustic soda, is found within seven miles of this well.

GAS PRODUCER PLANT, A LARGE.

Eng. and Mining J., Nov. 4, 1889, 541 *and* 547.

The entire operation of a large shop by gas engines using producer gas is new, and the first instance deserves special notice.

In the producer plant which is now at work in the new shops of the Erie Railroad Company in Jersey city the producers are of the Taylor pattern, using rice coal—the smallest and cheapest size of anthracite—and the plant is a simple and compact one, taking up much less space and requiring far less labour and attention than would steam boilers furnishing the same power. The working of the plant thus far has been entirely satisfactory, and the records show a consumption of only 1·1 lb. of the rice coal per horse-power hour, while the average duty of the engines is equal to 22 per cent. of the theoretical efficiency of the fuel consumed. These results would have been considered impossible only a few years ago; but they are now attained, ot in any special trial, but under the conditions of regular aily service. They reflect great credit upon the designers nd constructors of the plant. We may add that in its onstruction machinery is used wherever possible, so that he operation is largely automatic, and the labour is reduced o the lowest possible point.

This is another instance showing the great economies ossible in furnishing fuel to cities in the form of gas, nstead of coal. What can be so successfully done in one arge industrial establishment can be carried out equally vell on a great scale; while the economy and convenience of transporting and delivering the gas will add to the gain.

PATENT MEDICINES IN NEW SOUTH WALES.

Comm. Intelligence, Oct. 28, 1999, 11.

The *Miowera* of the Australian-Canadian Line arrived in Sydney Habour on Sept. 18th bringing, as portion of her American cargo from Vancouver, 248 cases of drugs, mostly patent medicines.

The New South Wales imports, however, show a decline in patent medicines in consequence of the increasing sale of locally manufactured articles.

PATENT MEDICINES IN RUSSIA.

Comm. Intelligence, Oct. 28, 1899, 14 ; *and*
Bd. of Trade J., Nov. 1899, 580.

Permission to import patent medicines into Russia must be obtained from the Russian Medical Council, which considers the application only when a full description of all the ingredients is given. Permission is granted if the medicine does not contain any injurious or poisonous substance, or substances which perish when kept for any length of time.

CALCIUM CARBIDE REGULATION.

Pharm. J., Nov. 25, 1899, 511.

Calcium carbide has now become an object of attention to the Thames Conservancy, and notice has been given by that body to the effect that—whereas calcium carbide presents dangers similar to those presented by petroleum, and whereas by an Order in Council on the 26th day of February, 1897, it was ordered and prescribed that certain parts of the Petroleum Acts, 1871 to 1881, shall apply to calcium carbide in the same manner as if it were petroleum to which the Acts apply, the carbide shall only be carried on the River Thames in metal drums, which shall be strongly made and securely closed, so as to be air-tight and water-tight. The quantity contained in any drum is not to exceed 140 lb. avoirdupois. Above or to the westward of Thames Haven, calcium carbide is only to be carried on the river Thames in open barges licensed for the purpose by the Conservators. At the same time nothing in the Conservancy bye-laws is to prevent the Conservators from giving permission in writing, under the hand of the secretary, for the carriage of small quantities of carbide on the Thames, above or to the westward of Thames Haven, in other than licensed barges, subject to any conditions specified in such permission.

NEW ALKALI WORKS IN AMERICA.

Chem. and Druggist, Nov. 25, 1899, 851.

The Columbia Chemical Company of Barberton, Ohio, has entered the soda-ash business, and has erected plant capable of producing 240,000 tons annually. The entrance of the new company in the field is likely to lead to a lively soda-ash war.

SPIRIT DRAWBACK IN GERMANY.

Chem. and Druggist, Nov. 25, 1899, 851.

According to a decree of the Bundesrath, of Oct. 19, the drawback on spirit utilised for the preparation of vinegar and exported abroad will remain, until further notice, at 6 m. (6*s.*) per hectolitre of pure alcohol. From Nov. 1, 1899, the former drawback of 3½ m. (3*s.* 6*d.*) will be raised to one of 4½ m. (4*s.* 6*d.*) on every hectolitre of pure alcohol for such spirits as are denaturalised.

PHARMACY IN RUSSIA.

Chem. and Druggist, Nov. 25, 1899, 851.

New regulations have been issued regarding the establishment of chemical factories and laboratories for the production of pharmaceutical preparations, and a list has been published of those manufacturers who may be allowed to manufacture and sell them wholesale. The managers of these institutions are to be persons who have had pharmaceutical training, and apprentices are only to be taken when "masters of pharmacy" are at the head.

SALTPETRE AND BORAX IN THE ARGENTINE.

Chem. and Druggist, Nov. 25, 1899, 851.

The Chemical Laboratory of the Department for Agriculture has been examining samples of the saltpetre found along the coast of the Atlantic (*Bahia blanca*). It contains, however, more impurities than the sort imported, but may be used for technical purposes.—In the province of La Rioja important borax-mines have been found which promise to pay well.

ASBESTOS IN CEYLON.

Chem. and Druggist, Nov. 25, 1899, 853.

It is reported that asbestos has been discovered in the southern province of Ceylon, thus opening up a new industry.

BOARD OF TRADE RETURNS.

SUMMARY OF IMPORTS.

Articles.	Month ending 31st October.	
	1898.	1899.
	£	£
Metals	1,657,870	2,534,005
Chemicals and dyestuffs	312,889	377,409
Oils	643,011	799,636
Raw materials for non-textile industries.	5,445,353	5,770,023
Total value of all imports	38,599,202	44,130,818

SUMMARY OF EXPORTS.

Articles.	Month ending 31st October.	
	1898.	899.
	£	£
Metals (other than machinery)	2,775,407	4,350,825
Chemicals and medicines	673,680	708,179
Miscellaneous articles	2,802,223	3,197,559
Total value of all exports	19,863,019	23,699,021

IMPORTS OF METALS FOR MONTH ENDING 31ST OCTOBER.

Articles.		Quantities.		Value.	
		1898.	1899.	1898.	1899.
Copper :—				£	£
Ore	Tons	8,114	19,318	66,900	176,505
Regulus	„	5,573	6,707	128,520	187,088
Unwrought	„	5,000	4,716	259,563	359,981
Iron :—					
Pig and puddled	„	13,478	10,816	54,501	43,917
Ore	„	317,345	553,074	232,842	419,858
Bolt, bar, &c.	„	8,553	6,627	74,406	56,283
Steel, unwrought	„	3,780	4,534	23,820	34,182
Lead, pig and sheet	„	17,245	17,925	221,423	282,457
Pyrites	„	44,361	50,709	75,267	78,704
Quicksilver	Lb.	102,710	..	10,051	..
Silver ore	Value £	..	..	97,378	78,327
Tin	Cwt.	33,716	67,152	126,423	480,324
Zinc	Tons	5,922	5,582	122,636	132,766
Other articles	Value £	..	..	164,140	203,613
Total value		..	..	1,657,870	2,534,005

IMPORTS OF CHEMICALS AND DYESTUFFS FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali............ Cwt.	23,424	21,452	13,308	12,136
Bark (Tanners', &c.) „	29,091	22,045	11,743	9,120
Borax .... „	46	118	46	93
Brimstone .... „	33,324	19,498	7,939	5,463
Chemicals...... Value £	..	..	92,921	127,774
Cochineal .... Cwt.	222	507	1,347	3,065
Cutch and gambier Tons	767	1,321	14,234	22,065
Dyes:—				
Alizarin.......Value £	..	..	16,872	20,120
Anilin and other „	..	..	40,546	49,637
Indigo .... Cwt.	369	620	6,069	9,095
Nitrate of potash.. „	19,631	21,890	13,283	17,752
Valonia .... Tons	1,389	1,144	14,553	12,060
Other articles ...Value £	..	..	80,028	89,029
Total value.........	..	..	312,889	377,409

IMPORTS OF OILS FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Cocoa-nut .... Cwt.	35,006	43,725	39,759	51,081
Olive............ Tuns	731	1,916	26,994	61,938
Palm .... Cwt.	65,953	87,898	71,728	96,863
Petroleum ...... Gall.	16,597,237	15,550,666	292,649	323,620
Seed............ Tons	2,922	3 243	61,888	67,228
Train, &c. ...... Tuns	1,942	3,158	30,040	51,507
Turpentine ..... Cwt.	34,207	33,066	40,095	61,064
Other articles Value £	..	..	79,858	86,335
Total value	..	..	643,011	799,636

IMPORTS OF RAW MATERIAL FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Bark, Peruvian .. Cwt.	1,382	1,813	2,589	4,320
Bristles.......... Lb.	283,286	361,530	27,288	38,290
Caoutchouc ...... Cwt.	41,600	42,414	526,172	466,567
Gum:—				
Arabic .... „	5,892	8,341	14,019	22,098
Lac, &c. .... „	2,605	5,666	8,431	26,417
Gutta-percha .... „	4,699	9,581	51,659	107,813
Hides, raw:—				
Dry............ „	26,283	37,042	68,669	91,072
Wet .... „	68,904	95,845	147,447	206,114
Ivory .... „	809	746	36,596	30,735
Manure:—				
Guano .... Tons	5,448	5,609	28,288	9,615
Bones.......... „	7,009	5,800	28,611	25,315
Nitrate of soda... „	6,588	5,609	48,553	39,937
Phosphate of lime „	24,039	33,721	34,820	55,263
Paraffin.......... Cwt.	79,693	77,317	70,461	75,263
Linen rags .... Tons	1,754	1,810	14,934	14,256
Esparto .... „	11,319	15 565	47,792	59,791
Pulp of wood:—				
Chemical ...... „	15,916	12,556	102,121	99,008
Mechanical .... „	18,198	16,878	52,052	41,958
Rosin............ Cwt.	68,014	74,161	15,060	18,575
Tallow and stearin „	233,754	143,603	239,834	182,188
Tar ....Barrels	17,145	25,383	14,152	24,389
Wood:—				
Hewn.......... Loads	270,910	255,348	533,897	507,136
Sawn .... „	946,701	873,080	2,138,870	2,116,931
Staves .... „	15,428	12,017	53,268	58,525
Mahogany ..... Tons	9,154	6,193	86,911	61,650
Other articles....Value £	..	..	1,052,859	1,392,787
Total value	..	..	5,445,353	5,770,023

Besides the above, drugs to the value of 86,137*l*. were imported, as against 68,436*l*. in October 1898.

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Brass............ Cwt.	9,084	10,840	41,074	53,412
Copper:—				
Unwrought.... „	52,664	100,979	139,590	405,015
Wrought ...... „	27,984	19,741	88,683	88,664
Mixed metal... „	18,246	10,193	45,463	34,287
Cutlery ....Value £ Hardware .... „	..	..	173,443	197,985
Implements...... „	..	..	115,637	134,267
Iron and Steel ... Tons	261,340	370,539	1,837,328	2,774,257
Lead............. „	4,323	3,332	58,636	53,828
Plated wares... Value £	..	..	48,496	52,206
Telegraph wires.. „	..	..	89,313	369,243
Tin .... Cwt.	8 342	8,861	32,183	65,152
Zinc .... „	14,336	11,132	13,431	13,511
Other articles...Value £	..	..	92,130	108,998
Total value	..	..	2,775,407	4,350,825

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali .... Cwt.	375,239	318,838	102,657	88,221
Bleaching materials „	103,198	102,670	28,069	25,290
Chemical manures Tons	32,154	37,255	169,306	188,383
Copper sulphate .. „	576	699	9,523	16,195
Medicines....... Value £	..	..	100,481	105,129
Other articles... „	..	..	263,644	284,961
Total value	..	..	..	..

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH ENDING 31ST OCTOBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Gunpowder. ... Lb.	517,400	832,100	10,850	16,413
Military stores.. Value £	..	..	146,718	207,573
Candles......... Lb.	2,052,900	2,535,400	28,535	37,967
Caoutchouc..... Value £	..	..	118,975	134,110
Cement......... Tons	31,432	32,239	62,197	63,364
Products of coal. Value £	..	..	117,835	143,801
Earthenware ... „	..	..	145,556	184,900
Stoneware ...... „	..	..	14,926	14,351
Glass:—				
Plate .... Sq. Ft.	186,487	202,883	10,852	11,679
Flint .... Cwt.	9,077	8 007	20,477	20,375
Bottles .... „	64,314	78,886	30,942	35,753
Other kinds ... „	19,490	23,585	16,414	22,069
Leather:—				
Unwrought .... „	13,098	13,137	113,320	129,879
Wrought......Value £	..	..	43,156	46,658
Seed oil .... Tons	3,287	2,616	59,421	56,870
Floorcloth.......Sq. Yds.	1,684,100	1,829,200	72,700	84,047
Painters' materials Val. £	..	..	141,551	165,032
Paper............. Cwt.	72,868	82,462	111,278	120,649
Rags.............. Tons	4,290	5,978	20,675	31,003
Soap .... Cwt.	60 710	70,590	71,622	76,734
Total value	..	..	2,802,223	3,197,559

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

20,732. W. J. Cruyt. Improvements in accumulators for mixed fluids under pressure. Oct. 16.

20,809. G. MacDonald. Improvements in filter presses and moulding presses. Oct. 17.

20,850. A. Smith, F. Smith, and A. S. Muir. A certain new and useful apparatus and process for filtration purposes. Complete Specification. Oct. 18.

20,956. A. J. Boult.—From The Park and Lacy Company, United States. Improvements in or relating to machines for compressing air and other compressible fluids. Complete Specification. Oct. 19.

21,112. F. T. Bond. Improvements in the filtration of liquids and in appliances therefor. Oct. 23.

21,142. H. J. B. Thiroux. Improvements in siphon apparatus for decanting liquids. Complete Specification. Oct. 23.

21,160. A. J. Boult.—From C. Krausse, Germany. Improvements in or relating to refrigerating apparatus. Complete Specification. Oct. 23.

21,292. T. Veevers. Improvements in or relating to vacuum boiling pans. Oct. 25.

22,361. G Friess. Machine for charging liquids with gases, especially water with carbonic acid. Nov. 9.

22,392. C. B. van Horn. Improvements in apparatus for carbonating liquids. Complete Specification. Nov. 9.

22,438. W. M. Miller. Improvements in and relating to evaporating, boiling and drying appliances. Complete Specification. Nov. 10.

22,546. N. Caro. Improvements in apparatus for drying, heating, or distilling wood, peat, coal and the like. Nov. 11.

22,563. J. B. Alliott. Improvements in or relating to filter presses. Nov. 11.

22,787. A. Totte. Improvements in apparatus for digesting and concentrating, or drying organic substances. Complete Specification. Nov. 15.

22,966. F. A. McRae and C. E. Robertson. Improvements in air compressors. Nov. 17.

22,972. W. Chattaway. Improvements in vessels used for concentrating liquids by heat. Nov. 17.

Complete Specifications Accepted.*

1898.

22,279. F. G. Maardt. Continuously operating kilns. Oct. 25.

24,498. J. Davie. Apparatus for evaporating water or other liquids by means of steam. Nov. 22.

25,068. S. Puplett. Condensers and evaporators. Nov. 8.

26,214. E. B. Phillips and W. H. Bray. Electrical furnace. Nov. 15.

26,282. G. I. Cree. Charring furnace. Nov. 8.

26,981. W. Mather. Means for evaporating and concentrating liquid solutions, and in obtaining solid substances from such solutions. Nov. 1.

27,393. J. B. F. Herreshoff. Roasting furnaces. Feb. 15.

27,436. A. S. Barham. Apparatus for sterilising milk or other liquids. Nov. 1.

1899.

731. G. R. Seton. Apparatus for cooling liquids. Nov. 15.

833. E. Marsh, F. Marsh, and W. Marsh. Construction of centrifugal pumps for lifting acids or acid liquors. Nov. 15.

2019. C. G. E. Salzberger. Filtering apparatus. Nov. 22.

7357. W. P. Thompson.—From A. Froment, Italy. Process and apparatus for condensing arsenious acid, metallic fumes and the like. Nov. 15.

16,614. G. J. Clarkson.—From C. E. Snypp, United States. Presses for expressing or filtering liquids from solids. Oct. 25.

18,253. W. P. Thompson.—From W. F. Fritz and H. A. Alioth, Switzerland. Apparatus for drawing off determined quantities of liquid carbonic acid or compressed gases or vapours. Nov. 22.

19,085. S. H. Emmens. Refrigerating and refrigerants. Nov. 1.

19,353. L. Timar. Apparatus for starting crystallisation. Nov. 22.

19,465. H. Korrodi. Capsules for containing compressed or liquefied gases. Nov. 1.

19,682. F. Brand. Charcoal kiln. Nov. 22.

II.—FUEL, GAS, AND LIGHT.

Applications.

1898.

20,668. R. C. Sayer. Improvements in obtaining heat and vaporising fluids by electricity. Complete Specification. Oct. 16.

20,690. J. Wilkinson. Improvements in the method of and in apparatus for use in the manufacture of an improved gas for obtaining light, heat, and power. Oct. 16.

20,792. W. Irwin. Improvements in apparatus for carburetting or enriching gas. Complete Specification. Oct. 17.

20,873. E. Springborn. Improvement in the method of drying peat. Oct. 18.

20,884. F. Trendel. Process for the production of solid igniting bodies for automatic gas igniters. Complete Specification. Oct. 18.

20,924. J. H. Dale and W. H. Bushell. Improvements in heating by gas and air. Oct. 19.

20,948. E. Springborn. A new method for converting road dust or carbon soil into fuel. Oct. 19.

21,001. W. H. Dance. Improvements in carbonic acid gas generators. Oct. 20.

21,020. J. Szilasi and S. Bernauer. An improved incandescent light burner for liquid hydrocarbons. Oct. 20.

21,035. C. Kellner. Improved manufacture of acetylene. Complete Specification. Oct. 20.

21,086. P. Noël. An improved gas-burner for heating and lighting by incandescence. Oct. 21.

21,200. J. Jackson. Improvements in and relating to incandescence gas burners. Oct. 24.

21,297. G. Stevenson and F. Stevenson. Improvements in apparatus for the generation and storage of acetylene gas. Oct. 25.

21,333. E. Edwards.—From T. Drescher, Germany. *See* Class VII.

21,349. R. Starke. The production of compressed blocks of calcium carbide and means for protecting the same from damp. Oct. 25.

21,407. L. Jacot and F. Schaller. Apparatus for automatically generating acetylene without pressure. Oct. 26.

21,558. A. J. Boult.—From G. Skaruppe, Germany. Improvements in apparatus for igniting illuminating gas at burners. Complete Specification. Oct. 28.

21,599. W. H. Stevenson. An incandescent gas cone for use with incandescent gas burners and mantles for increasing the light with a lower gas pressure and a smaller consumption of gas than has been the case hitherto. Oct. 30.

21,926. G. R. Hislop. Improvements in calcining apparatus for the revivification or recovery of spent limes resulting from the purification of gas, soda, and bleaching powder wastes, small limestone, and the like. Nov. 2.

21,934. H. Sutcliffe. Improvements in apparatus for generating, washing, cooling, and storing acetylene and other similarly prepared gases. Nov. 2.

22,069. W. P. Maxson and H. L. Reed. Improvements relating to acetylene gas generators. Nov. 4.

22,082. R. Fallnicht. Improvements in compressed fuel. Complete Specification. Nov. 4.

22,110. J. A. Clémence.—From A. Husson, Switzerland. Improvements in acetylene generators. Nov. 4.

22,111. E. Edwards.—From M. Stindl, Austria. Improvements in apparatus for generating acetylene gas. Nov. 4.

22,147. J. Craveri. See Class XII.

22,162 E. W. Lancaster. Improvements in acetylene generators. Nov. 6.

22,201. C. Cory and A. E. Tucker. Improvements in the manufacture of patent fuel. Nov. 7.

22,425. G. J. Atkins. Improvements in or connected with the manufacture of acetylene or other hydrocarbons from carbide and by-products thereof. Nov. 9.

22,466. E. F. Andrews. Improvements in and relating to the manufacture of coke. Nov. 10.

22,516. A. Stern. Improved regulated liquid trap for the gas-delivery pipes of acetylene gas generators. Complete Specification. Nov. 11.

22,527. W P. Thompson.—From the firm of Gebrüder Buxbaum, Germany. Improvements in apparatus for carburetting air or producing "air-gas." Complete Specification. Nov. 11.

22,584. W. Driver and J. Ramsay. Improvements in the cleansing of the ascension pipes of gas retorts and similar pipes. Nov. 13.

22,720. H. Simmons. Improvements in apparatus for the generation of acetylene gas. Nov. 14.

22,825. M. Waissbein. Improvements in the production of briquettes or blocks of small coal, graphite, sand, and other substances, and apparatus for the purpose. Nov. 15.

22,828. W. Ross. Improvements in acetylene gas generating apparatus. Nov. 15.

23,032. J. Y. Johnson.—From Compagnie Française de l'acetylène dissous, France. Improvements in acetylene gas burners for use in incandescent lighting. Complete Specification. Nov. 18.

Complete Specifications Accepted.

1898.

22,272. A. D. Williamson. Means for generating, purifying, storing, and distributing acetylene gas. Nov. 1.

22,330. G. Döllner. Process for purifying acetylene, and apparatus for the same. Oct. 25.

23,126. H. Niewerth. Means and method for heating air or gases. Nov. 8.

24,007. L. Jacquinet. Incandescence burners. Oct. 25.

24,409. W. W. Beech and H. Jones. Apparatus for generating and storing acetylene and other gases. Nov. 22.

24,771. F. W. Lanchester. Gas generators. Oct. 25.

24,785. C. J. Bailey and J. H. Nicklin. Apparatus for generating acetylene gas. Nov. 22.

26,221. F. Missire and M. L. Missire, *née* M. L. Magnin. Mantles for incandescence gas lighting. Nov. 1.

26,253. R. Brunck. Process of coking, with the recovery of by-products. Nov. 22.

26,474. L. Denayrouze. Incandescence lamps for burning oils, alcohol, and other volatile fluids, also solid fats and resinous substances Oct. 25.

26,533. H. Rey. Process of producing carburetted air, and in apparatus therefor. Nov. 8.

26,697. W. T. Sugg. Compressing of gases. Oct. 25.

26,856. H. Kayser. Mantles for incandescent lighting. Nov. 1.

1899.

636. O. Imray.—From C. W. Beck, United States. Acetylene gas generators. Nov. 15.

1020. B. J. B. Mills.—From La Société Anonyme des Fontaines à Gaz, France. Apparatus used in the production of carburetted gas. Nov. 22.

10,151. L. Steiner. Apparatus for generating acetylene gas. Nov. 1.

10,410. C. K. Mills.—From G. Tabard, France. Apparatus for generating acetylene gas. Nov. 15.

14,457. J. Gridley. Firewood or fuel, and process of manufacturing the same. Nov. 22.

16,619. W. Knapp and R. Steilberg. Process of and apparatus for the production of illuminating gas. Nov. 22.

17,195. A. M. Clark.—From Süddeutsche Metallwerke Schad, Herbest, and Co., Germany. Acetylene lamps. Nov. 1.

17,631. C. B. Richard and F. Cahen. Generation of gas having acetylene as a base, and apparatus therefor. Nov. 1.

17,969. G. C. Marks. From J. Hemingway, United States. Method of and apparatus for treating fuel. Nov. 8.

19,345. A. E. Adolfon. Apparatus for generating acetylene gas. Nov. 8.

19,545. H. Schwinning. Means for dispersing or reflecting light for illuminating purposes. Nov. 22.

19,757. G. Hilgenstock. Coke ovens. Nov. 8.

20,256. F. Ginnasi. Acetylene gas generators. Nov. 22.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

Complete Specification Accepted.

1898.

26,253. R. Brunck. *See* Class II.

IV.—COLOURING MATTERS and DYES.

Applications.

20,848. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new brown colouring matter. Oct. 18.

20,859. H. H. Lake.—From Vidal Fixed Aniline Dyes, Ltd., and L. Haas, France. Improvements in the manufacture of colouring matters. Oct. 18.

20,876. H. H. Lake.—From Vidal Fixed Aniline Dyes, Ltd., and L. Haas. Improvements in the manufacture of colouring matters. Oct. 18.

20,942. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new colouring matters and of a product for use therein. Oct. 19.

20,997. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new colouring matters of the naphthalene series. Oct. 20.

21,029. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new azo colouring matters for wool, and their treatment on fibre. Oct. 20.

21,030. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of mordant dyeing colouring matters. Oct. 20.

21,138. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. New process for the production of an amidonaphthol sulphonic acid. Oct. 23.

21,155. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, Germany. Manufacture of green-blue colouring matters. Oct. 23.

21,330. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of para-oxy-para-amidodiphenylamine. Oct. 25.

21,496. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of blue dyestuffs for cotton. Oct. 27.

21,556. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new indigo colouring matter. Oct. 28.

21,571. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of colouring matters of the anthraquinone series. Oct. 28.

21,572. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of products suitable for use in the preparation of colouring matters Oct. 28.

21,947. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Improvements in the manufacture and production of nitrobenzaldehydes. Nov. 2.

22,105. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Improvements in the manufacture of oxidation products of nitro-toluene. Nov. 4.

22,177. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new azo colouring matters. Nov. 6.

22,202. C. Mensching, I. Levinstein, and Levinstein, Ltd. The manufacture or production of polyazo dyestuffs. Nov. 7.

22,633. R. B. Ransford.—From L. Cassella and Co., Germany. Production of nitro amidonaphtholsulpho acid and of colouring matters derived therefrom. Nov. 13.

22,640. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new materials suitable for use in the manufacture of colouring matters. Nov. 13.

22,804. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. A new process for the production of dinaphthylamine derivatives. Nov. 15.

22,886. H. H. Lake.—From Chemical Works formerly Sandoz, Switzerland. Improvements in the manufacture of colouring matters. Nov. 16.

22,944. R. Holliday and Sons, Ltd., J. Turner, H. Dean, and J. Turner. Improvements in the production of colouring matters containing sulphur. Nov. 17.

Complete Specifications Accepted.

1898.

25,634. G. B Ellis.—From La Société Chimique des Usines du Rhône, anciennement G. P. Monnet et Cartier, France. Manufacture of indigo colouring matters and intermediate products. Nov. 8.

26,625. G. B. Ellis.—From La Société Chimique des Usines du Rhône anciennement G. P. Monnet et Cartier, France. Manufacture of new sulphonic acids from indigo colouring matters. Nov. 15.

27,345. R. B Ransford.—From L. Cassella and Co., Germany. Production of a new trioxynaphthalene and dyestuffs derived therefrom. Nov. 1.

1899.

198. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of brown dyestuffs from wool. Oct. 25.

256. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of new anthraquinone derivatives. Nov. 22.

286. O. Imray. From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of dyestuffs from dinitro-anthrachrysone. Oct. 25.

1033. J. Imray.—From La Société L. Durand, Huguenin et Cie, France. Manufacture of new colouring matters derived from paraphenylenediamine for dyeing wool. Nov. 15.

1034. O. Imray.—From The Farbwerke vormals Meister, Lucius und Bruning, Germany. Manufacture of indoxylmethylketone. Nov. 8.

1468. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of new mono-azo dyestuffs for wool. Nov. 1.

1766. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of blue basic dyestuffs insoluble in water. Oct. 25.

2360. C. D. Abel.—From The Actien Gesellschaft für Anilin Fabrikation, of Berlin, Germany. Manufacture of black dis-azo colouring matters. Nov. 22.

8503. H. H. Lake.—From Chemical Works, formerly Sandoz, Switzerland. Manufacture of azo colouring matters. Nov. 1.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

20,827. E. Lodge and J. Frost. A new or improved process for improving the appearance of textile fabrics. Oct. 18.

20,907. A. Badoil. Improvements in the method of and apparatus for retting or steeping flax. Filed Oct. 19. Date applied for, April 15, 1899, being date of application in Belgium.

20,909. A. Badoil. An improved process for the extraction of lignin and other matter from flax stalks. Filed Oct. 19. Date applied for, April 15, 1899, being date of application in Belgium.

21,087. H. K. Tompkins. Improvements in the manufacture of artificial fibres. Oct. 21.

21,192. F. Cochrane. Improvements in apparatus for "mercerising" cotton cloth under tension. Oct. 24.

21,364. C. Edmeston and E. Reuss. A process for the treatment of mercerised yarns and fabrics. Oct. 26.

21,566. J. J. Jackson. Improvements in apparatus for treating yarns with mercerising and other liquors. Oct. 28,

21,935. E. C. B. Saxby and R. Saxby. Improvements in the treatment of vegetable matters consisting chiefly of cellulose. Nov. 2

22,058. H. Cruse and J. Sampson. Mercerising cotton and other fibres in the "wool" or other condition prior to being spun. Nov. 4.

22,204. A. R. Donisthorpe and G. White. Improvements in the production of coloured yarns and in fabrics made thereby. Nov. 7.

22,292. W. P. Thompson.—From A. Wyser, Switzerland. Improvements in apparatus for mercerising yarns. Nov. 7.

22,391. E. Heusch. The production of imitation fabrics. Complete Specification. Nov. 9.

Complete Specifications Accepted.

1898.

24,768. A. Bouret and F. Verbiese. Process for retting or steeping vegetable textile fibres. Nov. 22.

1899.

14,232. E. Maertens. Process and apparatus for cleaning wool and other animal fibres. Nov. 22.

16,647. W. Brothers. Treating of textile fabrics or materials for the purpose of filling or weighting the same. Nov. 15.

18,657. J. A. A. Imbs. Apparatus for preparing wool, cotton or other fibrous material for spinning. Nov. 1.

19,936. R. Brandts. Process for mercerising cotton previous to weaving. Nov. 15.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, and BLEACHING.

Applications.

20,825. C. L. Jackson. Improvements in washing mercerised textile fabrics and in apparatus or means therefor. Oct. 18.

21,090. O. Gruhne. Improvements in centrifugal dyeing machinery or apparatus. Complete Specification. Oct. 21.

21,287. C. E. Middleton, F. P. Middleton, and A. T. Middleton. Improvements in fancy dyeing and weaving. Oct. 25.

21,488. L. Weldon. Improvements in machines for use in dyeing yarns. Complete Specification. Oct. 27.

21,489. L. Weldon. Improvements in machines for use in dyeing yarns. Complete Specification. Oct. 27.

22,061. J. Smith. Improvements in or connected with dyeing textile materials black. Nov. 4.

22,573. J. Rhodes, jun. Improvements in apparatus for scouring, dyeing, and similarly treating hanks of yarn, slubbing, raw wool, and other fibrous material. Nov. 13.

22,583. J. H. Lees-Milne. Improvements relating to the spinning and bleaching of yarns. Nov. 13.

22,609. W. H. Eastwood. Improvements in apparatus for use in subjecting warps or yarns or threads in other forms, or woven fabrics or paper, or other materials in the form of bands, ropes, or continuous sheets, to treatment with, or the action of size, or filling, or dyes, or other liquids or materials, or gases, or vapours, or to beetling, calendering, or other treatment wholly or partially mechanical, or of other kinds. Nov. 11.

22,927. W. W. L. Lishman, T. W. Haughton, J. J. Kirkpatrick, and The Lishman Process Bleaching Company, Ltd. Improvements in kiers for conturing liquors for boiling, bleaching, and dyeing purposes. Nov. 17.

22,948. P. Schirp. Improvements in the method of dyeing, washing, bleaching, and in the apparatus used therein. Complete Specification. Nov. 17.

Complete Specifications Accepted.

1898.

25,780. P. Villette. Machinery for dyeing textile fabrics in hanks or skeins. Nov. 8.

1899.

16,301. F. H. Oldroyd. Process of completely decolourising dyed fibrous material. Nov. 15.

VII.—ACIDS, ALKALIS, and SALTS.

Applications.

20,700. C. Wülfing. Improvements in the manufacture of ferrous ferric oxide and chlorammonium. Oct. 16.

21,333. E. Edwards.—From T. Drescher, Germany. Improvements in the process of preparing peroxide of hydrogen. Complete Specification. Oct. 25.

21,871. F. A. Gasch. Process for obtaining zinc solutions free from iron and manganese compounds. Complete Specification. Nov. 1.

21,926. G. R. Hislop. *See* Class II.

22,161. W. T. Carter and H. A. Couvelas. Improvements in or connected with the manufacture of calcic carbide. Nov. 6.

22,229. J. T. A. Walker. An improved method of treating lime sludge from caustic soda manufacture. Nov. 7.

22,403. R. Pearson. Improved process for the production of ammonia. Nov. 9.

22,576. W. Marsh and J. Marsh. Improvements in the manufacture of carbonate of magnesia. Nov. 13.

23,024. G. N. Vis. Process for the purification of brine. Nov. 18.

Complete Specifications Accepted.

1898.

17,852. P. Naef. Method and apparatus for decomposing certain chlorides. Nov. 22.

24,643. H. C. Bull, A. C. Oakes, and T. M. Thom. Process for producing lime and obtaining carbonic acid. Nov. 22.

27,328. A. Martignier. Manufacture of cream of tartar Nov. 1.

27,376. J. W. Fisher, J. A. Hall, and F. Moore. Apparatus for use in the concentration of sulphuric acid. Nov. 8.

1899.

285. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of sulphur trioxide (sulphuric anhydride). Oct. 25.

1017. P. Imhoff and The United Alkali Company, Ltd. Manufacture of salts of the oxyhalogen acids, such as chlorates and hypochlorites, and the like. Nov. 15.

1859. G. W. Johnson.—From The Verein Chemischer Fabriken, Germany. Roasting furnaces more especially intended for roasting pyrites or the like, for the direct production of sulphuric anhydride from the gas evolved. Nov. 15.

5758. A. Dzuik. Process of manufacturing cyanides. Nov. 15.

VIII.—GLASS, POTTERY, and ENAMELS.

Applications.

20,695. R. Backhaus. Process for producing imitation paintings on glass mosaic work as transfer pictures. Oct 16.

20,936. A. Metz. Improvements in the manufacture of plain and ornamental or decorated ceramic ware, and moulded articles, panels, cornices, and the like. Complete Specification. Oct. 19.

21,264. C. H. W. Ruhe. Improvements in machines for blowing glass. Complete Specification. Oct. 24.

21,265. C. H. W. Ruhe. Improvements in glass blowing machines. Complete Specification. Oct. 24.

21,388. P. T. Sievert. Process of and apparatus for the production of hollow glass articles. Oct. 26.

21,946. F. K. Cheese. Improvements in glass tiles and in their manufacture. Nov. 2.

22,799. F. Archamboult. A preparation for the protection of carboys and other articles of glass, pottery, and the like. Filed Nov. 15. Date applied for Sept. 20, 1899, being date of application in France

22,817. E. Schroeder. Improvements in ovens or kilns for ceramic ware and other articles. Complete Specification. Nov 15.

Complete Specifications Accepted.

1898.

24,068. D Laffan and C. J. Bury. Production of marbled or painted surfaces on glass or the like. Nov. 22.

1899.

1880. R. Moser. New or improved method and means for the decolorisation of glass. Nov. 22.

15,370. T de Michalowsky. Secondary or storage battery. Nov. 8.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, and CEMENTS.

Applications.

20,929. G. de Bruyn. Improved artificial building stone. Complete Specification. Oct. 19.

20,930. G. de Bruyn. Improved artificial building stone. Complete Specification. Oct. 19.

21,185. M. Dumas. Process for preservation of natural or artificial siliceous argillaceous and calcareous substances. Complete Specification. Oct. 24.

21,353. P. Hobbs. Improvements in fireproof or fire- and sound-proof floors and ceilings. Oct. 25.

21,710. J. Wootton, J. Staley, and J. Parker. Improvements in or relating to the production of articles from clay or the like. Oct. 31.

21,759. E. Robbins. An improved concrete combination, means and method of producing the same *in situ* or factory, for roads, paving, architectural construction, and other works. Oct. 31.

21,779. C. Straub. Improvements in the process of treating lime in the manufacture of plaster, cement, and the like. Complete Specification. Oct. 31.

21,794. P. Jensen.—From G. Heine, Norway. Improvements in the manufacture of artificial sandstone. Oct. 31.

21,814. G. F. Leboida. An improved process for preserving wood. Complete Specification. Oct. 31.

22,530. J. Bassett. Improvements in and relating to the fire-proofing of buildings. Nov. 11.

22,549. J. C. Gostling, J. H. Frazer, and R. Booth. Improvements in or relating to apparatus for the manufacture of cement. Nov. 11.

22,714. C. Straub. Improvements in plaster cement and the like. Complete Specification. Nov. 14.

22,759. J. T. Szek. Improvements in the manufacture of artificial stone. Nov. 15.

Complete Specifications Accepted.

1898.

17,696. J. C. Swan. Kilns for burning cement-making materials, and for similar purposes. Nov. 22.

18,483. J. Steiger. Manufacture of cement. Nov. 1.

1899.

1302. L. Grabau. Cements. Nov. 22.

17,964. R. Haddan.—From G. Fugman, United States. Fireproof construction of buildings. Oct. 25.

19,168. H. R. Vaughan. Continuous burning kilns for burning bricks and other clay goods, and also for limes and cements. Nov. 22.

20,139. A. Catkosinski and L. Weintraub. Manufacture of bricks, tiles, artificial stone, and the like. Nov. 15.

X.—METALLURGY, MINING, Etc.

Applications.

20,808. W. J. Patterson. Improvements in and relating to casting metals. Complete Specification. Oct. 17.

20,939. L. Perin. Improvements in the manufacture of moulded blocks or masses of steel and other materials. Complete Specification. Oct. 19.

20,972. T. Twynam. Improvements in the recovery of tin from tin scrap. Oct. 20.

21,137. W. A. McAdams and D. D. Book. Improvements in aluminium alloys, and in the method of casting them. Complete Specification. Oct. 23.

21,213. W. A. Köneman and W. H. Hartley. Improvements in furnaces for roasting ores and the like. Complete Specification. Filed Oct. 24. Originally numbered 22,257 of 1898, now dated April 28, 1899, under sec. 2 Patent Act, 1888.

21,224. H. J. Haddan.—From A. S. Ramage, United States. Improved process for obtaining iron oxides. Complete Specification. Oct. 24.

21,346. C. T. Batchelor. Improvements in and relating to the recovery of tin from tin plate scrap and other waste tin products. Oct. 25.

21,397. A. Reynolds. An improvement in the smelting of iron ores and apparatus for that purpose. Oct. 26.

21,476. J. B. de Alzugaray. Improvements in extracting metals from their oxides and ores, and in forming alloys. Oct. 27.

21,787. A. Reynolds. An improvement in apparatus for smelting ores and melting metals. Oct. 31.

22,182. E. B. Parnell. Improvements in or relating to the extraction of metals from ores, and in apparatus therefor. Nov. 6.

22,444. J. Wiggin and J. Wiggin. Improvement in the method of casting. Nov. 10.

22,619. J. Diether and M. Merz. Process for winning gold from refractory ores. Nov. 13.

22,689. G. Harrison.—From The New Process Coating Company, United States. Improvements in galvanising apparatus. Complete Specification. Nov. 14.

23,014. A. Germot. A process of treatment of lead ores for obtaining metallic lead. Complete Specification. Filed 18th Nov. Date applied for 27th May 1899, being date of application in France.

Complete Specifications Accepted.

1898.

16,622. J. Ranald. Humid process for the extraction of the metals, bismuth and the like from their sulphide ores. Nov. 8.

21,138. W. T. Whiteman.—From E. Petersson, Belgium. Process for the treatment of sulphurous ores containing arsenic, antimony, or tellurium. Nov. 15.

23,386. G. E. Bourgoin. New fine alloy for hardening aluminium, increasing its strength and elasticity. Nov. 1.

23,437. G. E. Bourgoin. Brazing or soldering of objects made of aluminium or the like. Nov. 15.

23,902. G. E. Bourgoin. Soldering aluminium and its alloys. Nov. 22.

25,979. F. W. Martin and F. Stubbs. Treatment of ores and the precipitation of precious metals from their cyanide solutions. Nov. 1.

25,983. A. Lavoix. Amalgamating apparatus for extraction of precious metals from minerals. Oct. 25.

26,260. J. Patrick. Manufacture of nickel alloys. Nov. 8.

26,851. T. Turner. Ingots compounded of wrought iron or wrought steel and cast steel. Nov. 1.

1899.

552. A. C. J. Charlier. *See* Class XIII.

12,512. E. C. H. Pape and C. A. L. W. Witter. Process for roasting mixed sulphide ores. Nov. 1.

19,093. W. B. Johnson.—From J. S. Unger, United States. Carburising armour plates. Nov. 22.

XI.—ELECTRO-CHEMISTRY and ELECTRO-METALLURGY.

Applications.

20,818. A. A. Beadle. Improvements in primary electric batteries. Oct. 18.

20,925. C. Luckow, junior. A process for directly obtaining the caustic lyes and ammonia and earth alkaline hydroxides by electrolysis. Complete Specification. Oct. 19.

20,986. W. W. Hanscom and A. Hough. Improvements in machines for and the method of making electrodes for storage batteries. Complete Specification. Oct. 20.

21,076. B. Willcox.—From The Columbus Electricitätsgesellschaft, Gesellschaft mit beschränkter Haftung, Germany. Improvements in electric cells or batteries. Oct. 21.

21,562. H. Leitner. A separator for plates of secondary batteries. Oct. 28.

21,681. A. J. Boult.—From E. Perrot, France. Improvements in or relating to electric batteries. Oct. 30.

22,028. R. Eycken, C. Leroy, and R. Moritz. Improvements in or conneted with electrodes for electrolysers. Complete Specification. Filed Nov. 3. Date applied for May 3, 1899, being date of application in France.

22,143. E. C. H. T. Lugard. Improvement in electrical accumulators. Nov. 6.

22,384. J. Post. Improvements in and relating to chemical electrical excitants. Complete Specification. Nov. 9.

22,554. L. Gaster. Improvements in processes and appliances for obtaining carbon suitable for electrical and other industrial purposes such as the manufacture of electrodes and calcium carbide, and at the same time obtaining a superior quality of pitch. Nov. 11.

22,710. H. L. Lake.—From S. Stepanor, Russia. Improvements in apparatus for the electrolytic extraction of zinc. Complete Specification. Nov. 14.

22,807. H. Beckmann. Improved manufacture of lead peroxide and its application to electrical storage batteries. Nov. 15.

22,829. Phelp's Metal, Ltd.—From C. J. Hubbell, United States. A material or composition suitable for electric battery cases, insulating and other purposes, and method of manufacturing the same. Nov. 15.

22,830. S. Robinson.—From S. R. V. Robinson, United States. Improvements in primary batteries. Nov. 15.

22,832. C. A. Sahlström. Improvements in batteries for the generation of ozone and for like purposes. Nov. 15.

23,033. W. Schlothauer. Improvements in secondary batteries. Nov. 18.

23,040. A. J. Boult.—From F. Störmer, Germany. Improvements in or relating to apparatus for the electrolysis of alkali chloride solutions. Complete Specification. Nov. 18.

Complete Specifications Accepted.

1898.

22,070. C. Levetus. Galvanic and other batteries. Oct. 25.

23,306. C. Levetus. Galvanic batteries. Nov. 8.

24,104. E. Wilson and J. M. Cater. Apparatus connected with the charge and discharge of storage cells. Nov. 15.

24,570. W. S. Rawson. Electric batteries. Nov. 22.

26,343. C. Brault. Manufacture and production of plates or elements for secondary batteries or electrical accumulators. Oct. 25.

26,703. H. T. Harrison. Primary batteries. Nov. 8.

1899.

537. J. S. Highfield. Pressure-regulating apparatus for electric mains, used chiefly in connection with storage batteries. Nov. 15.

2748. C. D. Abel.—From La Société d'Etude des Piles Electriques, France. Primary electric batteries. Nov. 15.

11,930. T. M. I. Wilhelm and H. Richard. Electrolytic apparatus. Nov. 15.

17,258. A. J. Boult.—From J. Trillet, France. Galvanic batteries. Nov. 15.

18,254. E. F. A. Polzin. Construction of accumulator plates. Nov. 8

XII.—FATS, OILS, and SOAP.

Applications.

20,950. A. F. Lundeberg. Improvements in the method of extracting vegetable oils by pressure. Oct. 19.

21,713. S. Bender. Apparatus for recovering oils from condensation water by filtration. Complete Specification. Oct. 31.

22,147. J. Craveri. Composition for wax tapers for friction matches. Complete Specification. Nov. 6.

22,231. W. E. Shaw. An improvement in the method of refining and purifying linseed and other oils by treatment with oxygen and its allied gases. Nov. 7.

Complete Specification Accepted.

1899.

18,439. A. Kürten. Washing and cleaning compound. Nov. 1.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

Applications.

20,934. W. J. Cordner. The synethic production of india-rubber. Oct. 19.

21,109. C. O. Weber and I. Frankenburg. Improvements in compounded india-rubber. Oct. 23.

21,134. M. Frank. Improvements in insulating material. Complete Specification. Oct. 23.

21,224. H. J. Haddan.—From A. S. Ramage, United States. *See* Class X.

21,626. L. S. Jones. The extraction of shellac and dyes and gums from hatters' felts by means of alcohol applied by a special process. Oct. 30.

22,337. G. Wegelin. Improvements in the manufacture of soot or lamp-black from tar and other carbonaceous substances. Complete Specification. Nov. 8.

22,345. A. E. Peyrusson and E. Peyrusson. Improvements in the production of vitrifiable colours, enamels, and the like. Nov. 8.

22,818. J. A. de la Fontaine. Improvements in the manufacture of white lead. Nov. 15.

22,971. L. Burger. Improvements in the manufacture of bronze printing materials. Complete Specification. Nov. 17.

Complete Specifications Accepted.

1898.

21,830. Mathews' Lancashire, Cheshire, and North Wales District White Lead Company, Ltd., S Pope and G. V. Barton. Apparatus employed in the production of lead oxide and the treatment of rough litharge. Oct. 25.

24,211. The East Ferry Road Engineering Works Company, Ltd., F. S. Tuckett, L. Lancaster, and W. W. and R. Johnson and Sons, Ltd., and E. M. Johnson. Method of and means for drying white lead. Nov. 22.

26,157. J. de la Fresnaye. Process and apparatus for the extraction of substances contained in vegetable and other bodies, especially applicable to the extraction of rubber, and the recovery of the solvents employed. Nov. 8.

26,434. H. C. Webster and T. French. Apparatus for use in drying white lead. Nov. 15.

1899.

552. A. C. J. Charlier. Process for the manufacture of white lead and for the recovery of silver in said process. Nov. 22.

11,957. A. Turski. Process for the manufacture of oil colours. Nov. 15.

XIV.—TANNING, LEATHER, GLUE, and SIZE.

Applications.

21,074. H. B. Burnell. Improved process of and means for the tanning of skins. Oct. 21.

21,400. A. T. Wedelin. Tanning by aid of electricity. Oct. 26.

22,547. F. Arledter and G. Huth. Improvements in the manufacture of rosin size and in apparatus therefor. Complete Specification. Nov. 11.

Complete Specifications Accepted.

1898.

22,318. J. F. Jones and E. S. Clegg. Apparatus for the tanning of hides and skins. Nov. 1.

1899.

2781. S. A. Haynes. Artificial glue and size. Oct. 25.

6402. F. W. Golby.—From G. Bierich, Russia. Process for the production of a homogeneous horn substance from horn cuttings, horn shavings, powdered horn, or the like. Oct. 25.

10,408. R. Brauer. Process of extracting tannin from leather, and preparing the latter for glue making. Nov. 22.

14,775. C. S. Dolley and A. F. Crank. Process of tanning. Nov. 22.

XV.—AGRICULTURE AND MANURES.

Applications.

21,484. A. J. Leopold of Forselles. An improved method of producing a fertilizer rich in phosphoric acid and a phosphorous pig-iron. Complete Specification. Oct. 27.

22,497. R. Marrison. Condensed blood fibrene manure. Nov. 10.

Complete Specification Accepted.

1898.

25,475. A. Frank and N. Caro. Manufacture of nitrogen compounds. Nov. 8.

XVI.—SUGARS, STARCHES, GUMS, Etc.

Applications.

22,277. J. H. Lavollay and G. E. Bourgoin. Improvements in purification and decolorisation of saccharine liquids and syrups. Nov. 7.

22,715. I. Kitsée. Improvements relating to the bleaching of sugar juices. Complete Specification. Nov. 14.

22,995. R. A. Robertson, of the firm of W. Laidlaw and Co. Improvements in a method of defecating cane juice during the manufacture of sugar, and in apparatus therefor. Nov. 18.

Complete Specifications Accepted.

1898.

26,475. E. Luck and S. G. Luck. Purifying and decolorising saccharine liquors. Nov. 8.

1899.

3759. W. P. Thompson.—From G. Eichelbaum, Germany. Purifying vegetable and animal albumen and substances containing the same. Nov. 15.

7190. P. Porchére. Production of sweetening liquids. Nov. 22.

15,815. H. Fischer. Process of and apparatus for obtaining ammonia and its salts from the spent liquor of molasses and from vinasse. Nov. 1.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

20,955. C. W. Ramsay. Improvements in or relating to the distillation and purification of alcoholic liquids. Oct. 19.

22,036. E. Rawlings and The Brewers and Distillers Co., Ltd. An improved method and means for the carbonating of beer or other liquids. Nov. 3.

22,484. A. D. W. King and J. H. Howell. A new or improved process and apparatus for the fermentation of beer. Complete Specification. Nov. 10.

22,558. W. Smithson. An improved preparation of yeast. Nov. 11.

22,706. C. Sudre and C. V. Thierry (signing as Ch. Thierry). An improved process for treating distillers wash. Nov. 14.

22,798. O. G. C. J. Overbeck. The production of alcohol and of non-alcoholic beer. Nov. 15.

23,057. A. Meyer. New or improved fermenting process especially for use in brewing. Complete Specification. Nov. 18.

Complete Specifications Accepted.

1898.

24,253. W. Cutler. Construction of union casks used in brewing operations. Nov. 15.

24,751. J. Heron. Fermentation for the production of alcohol in the manufacture of beer, wines, and the like. Nov. 22.

25,505. H. Vuylsteke. Apparatus for carbonating beers. Oct. 25.

25,974. J. Imray. — From La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis and D. A. Rosenstiehl, France. Manufacture of cider for retarding the fermentation of the apple juice. Oct. 25.

1899.

24. E. Scholes. Apparatus for purifying, treating, and aërating beer and other beverages. Nov. 22.

XVIII.—FOODS, SANITATION, Etc., and DISINFECTANTS.

Applications.

A.—Foods.

20,898. J. J. Broadfoot. A method of preserving milk and cream. Oct. 19.

21,149. W. P. Thompson.—From W. Lehrke, Germany. Improved manufacture of a highly nitrogenous food. Oct. 23.

21,193. J. Flockhart and J. Shaw. Improved apparatus for sterilising milk, also applicable for other purposes. Oct. 24.

22,160. M. Andersen, S. Jensen, and A. Holstebroe. A new or improved method of preserving eggs. Nov. 6.

22,772. B. Kershaw. Improvements in and connected with the manufacture of fabrics used for covering meat. Nov. 15.

B.—Sanitation.

20,759. T. J. Barnard. Improvements in or connected with the treatment of sewage. Complete Specification. Oct. 17.

21,451. L. Gathmann. Improvements in and relating to apparatus for purifying water or other liquids. Complete Specification. Oct. 27.

21,452. L. Gathmann. Improvements in apparatus for sterilising water or other liquids. Complete Specification. Oct. 27.

21,921. W. R. Hutton, jun. Improvements in and relating to the carbonising and obtaining of products from precipitated sewage sludge. Complete Specification. Nov. 2.

C.—Disinfectants.

20,712. H. H. Lake.—From Stackmann and Retschy's Chemical Works, Germany. An improved process for the production of disinfecting powder. Complete Specification. Oct. 16.

22,284. C. Goldschmidt. Improvements in the manufacture and production of compounds for use as antiseptics or disinfectants and for other purposes in medicine or surgery. Nov. 7.

22,862. C. M. Johnson. Germ destroyer. Nov. 16.

Complete Specifications Accepted.

A.—Foods.

1899.

61. O. Siebold. Process for the production of a relishing soluble albuminous meat extract. Nov. 1.

789. L. Dondy, of the firm of J. A. Roggers and Co. Form, kind, or manufacture of bread. Nov. 15.

19,802. J. H. Kellogg. Processes for preparing cereal cakes. Nov. 8.

B.—Sanitation.

1898.

23,562. W. Ross Hutton, jun. Utilisation of precipitated sewage sludge. Nov. 15.

25,383. C. A. Atkinson. Treatment or purification of sewage and apparatus therefor. Nov. 8.

25,660. J. F. Johnstone. Apparatus for treating and drying fish and other offal. Oct. 25.

1899.

10,586. H. Reisert. Process of and means for automatically cleansing filter material. Nov. 15.

19,379. J. O. Kröhnke. Method of purifying water. Nov. 1.

19,411. E. W. Ives. Method of and apparatus for the treatment of sewage and like liquids. Nov. 8.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

20,667. E. C. Staples, F. Greenwood, W. Brearley, and D. Woodhead. Improvements in or in connection with the water and grease proofing of paper, packing papers, cardboard, and the like, and articles made therefrom. Complete Specification. Oct. 16.

21,163. J. Wilson. Improvements in apparatus suitable for straining paper pulp. Oct. 23.

22,684. G. E. Skliros. Tobacco-plant paper and pulp. Nov. 14.

22,867. A. N. Petit. Improvements in the method of and solvent materials for treating surfaces of celluloid. Complete Specification. Nov. 16.

22,894. J. B. Bourseau. Improvements in the treatment of paper board. Complete Specification. Filed Nov. 16. Date applied for, April 26, 1899, being date of application in France.

Complete Specifications Accepted.

1898.

26,501. A Masson and R. Scott. Paper making machinery. Nov. 1.

1899.

189. C. D. Ekman. Treating the liquors resulting from the manufacture of cellulose or fibres by the sulphite process, in order to obtain useful products therefrom. Nov. 8.

10,798. J. A. Wheeler and S. W. Ellis. Process of moulding fibrous pulp. Nov. 1.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Applications.

20,701. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new pharmaceutical compounds. Oct. 16.

22,117. T. Gladysz. Improvements in the manufacture of cream of tartar. Nov. 4.

22,170. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Improvements in the manufacture or production of pharmaceutical compounds. Nov. 6.

22,179. A. Zimmermann.—From The Chemische Fabrik auf Actien vormals E. Schering, Germany. The production of non-poisonous pyrocatechin derivatives suitable for use in medicine. Nov. 6.

22,285. J. Y. Johnson.—From Vereinigte Chininfabriken Zimmer and Co., Germany. The manufacture and production of new derivatives of quinine and carbonic acid. Nov. 7.

22,639. J. Y. Johnson.—From Vereinigte Chininfabriken Zimmer and Co., Germany. Improvements in the manufacture of pharmaceutical preparations of quinine. Nov. 13.

Complete Specifications Accepted.

1898.

27,088. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of acetyl salicylic acid. Nov. 8.

1899.

11,222. J. Bechtold. Process for making wine-chocolate extract. Nov. 1.

17,934. S. S. Bromhead.—From Chemische Fabrik Helfenberg Actien Gesellschaft, formerly E. Dieterich, Germany. Process for the production of bromide of albumen, bromide of peptone, and albuminous or peptonous derivatives of bromine. Nov. 8.

18,334. F. Raschig. Process for the separation of metacresol and paracresol. Nov. 15.

19,413. G. W. Johnson.—From C. F. Boehringer and Soehne, Germany. Manufacture or preparation of alkylised uric acid. Nov. 1.

XXI.—PHOTOGRAPHY.

Applications.

21,243. W. P. Thompson.—From A. W. McCurdy, United States. Improved process of and apparatus for developing and fixing photographic films. Complete Specification. Oct. 24.

22,613. A. Pollak, J. Virág, G. Egger, and F. Silberstein. Improved apparatus for photographically recording oscillating rays of light. Complete Specification. Nov. 13.

22,614. A. Pollak, J. Virág, G. Egger, and F. Silberstein. An improved automatic developing apparatus for photographic exposures. Complete Specification. Nov. 13.

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1898.

21,649. W. Friese-Greene. Taking and in projecting photographic images, in means therefor, and in photographic negatives. Oct. 25.

22,361. R. R. Beard. Photography. Nov. 1.

24,230. R. Greenland. Process of washing photographic prints, films, and the like. Nov. 22.

27,373. R. W. Artlett. Means applicable for use in orthochromatic photography. Nov. 8.

1899.

620. J. T. Sandell. Sensitised continuous films for photographic and cinematographic purposes. Nov. 15.

17,522. A. G. Adamson. Apparatus for photography by means of gas. Nov. 8.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

21,395. G. Beneké. An improved factory for the manufacture of explosives. Oct. 26.

21,788. The Diamond Match Company, Limited.—From C. H. Palmer and J. W. Denmead, United States. Method of and apparatus for the manufacture of matches made of paper or the like. Complete Specification. Oct. 31.

21,860. S. P. Thompson. Improvements in explosives. Nov. 1.

22,712. C. E. Bichel. Improvements in the manufacture of explosives. Nov 14.

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1898.

25,475. A. Frank and N. Caro. *See* Class XV.

26,893. W. F. Reid and E. J. V. Earle. Manufacture of safety fuse. Oct. 25.

27,316. L. Davies. Explosives. Oct. 25.

1899.

8680. T. H. Kelly, G. W. Bell, and R. N. Kirk. Explosive. Oct. 23.

17,961. C. Aldridge. Safety matches. Nov. 22.

PATENTS UNCLASSIFIABLE.

Application.

22,085. A. J. Boult.—From A. Nieski, Germany. Improvements in the treatment of materials for fireproof and preservative purposes. Complete Specification. Nov. 4.

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1898.

23,981. J. H. W. Stringfellow. Water-proof and acid-proof compounds. Nov. 1.

24,378. E. W. Engels. Fire and acid-proof materials. Nov. 1.

1899.

16,378. E. Dowie and The Faramel Manufacturing Company, Limited. Composition of matter. Nov. 1.

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Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—p. 8277.

THE JOURNAL
OF THE
Society of Chemical Industry.

A MONTHLY RECORD
FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 12.—Vol. XVIII.] DECEMBER 30, 1899. [Non-Members 30/- per annum; Members 21/- per Set of extra or back numbers; Single Copies (Members only) 2/6.

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Mr. J. W. Hinchley, Wh.Sc., A.R.S.M. "Colour Photography."
Mr. J. M. Vargas-Vergara, F.C.S. "Cinchona."
Mr. R. M. Prideaux. "Microscopic Character of Vicuña, Camel-hair, and Alpaca."

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Friday, Jan. 5th. Mr. J. G. A. Rhodin, F.I.C. "A Laboratory Method for the Analysis of Coal for Gas Manufacture."

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NOTICES.

Prizes for the Solution of Industrial Problems.

It has been felt for some time that it would tend to the advancement of applied chemistry if the Society were to encourage manufacturers to bring their problems and difficulties under the notice of men of skill and experience, such as may be found in works and technical laboratories as well as in universities and colleges.

The Council is now prepared to consider applications from manufacturers and industrial associations who desire to avail themselves of such assistance.

The order of procedure will be as follows:—

The manufacturer or his representative will read a paper at one of the Sectional Meetings setting forth clearly and fully the nature of the problem awaiting solution, and the conditions, chemical, physical, and economic by which it is surrounded. Sufficient statistical information will be supplied to give a fair general idea of the scope and magnitude of the problem. This paper would appear in the Society's Journal, and would serve as a guide to the competitors and a standard of reference to the prize committee which the Council would appoint to regulate the competition.

When the manufacturer or Industrial Association offers a sum of money for a prize or prizes, the Council will accept that sum in trust on behalf of the prize committee.

Problems may be dealt with in several ways, of which the following will serve as illustrations:—

(1.) Special investigations bearing on the subject, apart from the suggestion of practical applications of the facts discovered.

(2.) Practical solutions of problems. The competitors might patent these.

(3.) Essays on the work of others which might bear on the solution of problems.

These last would be a valuable training for students, while the essays themselves would serve as a starting point for new investigations, and would enhance the value of the Society's Journal.

The first prize competition under this scheme is now set forth on p. 1098. The Scottish Papermakers' Association offers prizes to the value of 100*l.* for solutions of certain problems connected with their industry. Mr. R. C. Menzies describes the nature of the problems, and the Prize Committee appointed by the Council lays down the conditions of the competition. Subsequent problems will be advertised from time to time under the Society's official list of notices in the Journal.

Members are reminded that the subscription of 25*s.* for 1900, payable on January 1st, 1900, should be sent in good time to the Treasurer (Mr. Samuel Hall), in order to ensure continuity in the receipt of the Society's Journal. Any changes of address to appear in the new List of Members now in course of preparation, should reach the General Secretary not later than January 15th next.

Collective Index.

The Collective Index (1881—1895) is now ready. The prices are as follows:—

To Members and Past Members; Libraries, Societies, and Exchanges on the Society's List	Each copy	10*s.*
To Subscribers	„	12*s.* 6*d.*
To others	„	15*s.*

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Hodges, Dr. J. F., 14, Alfred Street, Belfast. Dec. 13.

Kennedy, Wm., 28, Royal Exchange Square, Glasgow.

Sowter, Alfred, Sylvester Street, Coolgardie, West Australia.

Stanford, E. C. C., Glenwood, Dalmuir, N.B. Dec. 8.

Watson, Dr. D., Willow Bank House, Kersal Vale, Manchester. Dec. 15.

Liverpool Section.

Meeting held on Wednesday, November 29th, 1899.

MR. ALFRED SMETHAM IN THE CHAIR.

THE CLEANSING OF SPIRITS BY TREATMENT WITH COLD AIR.

BY R. C. SCOTT.

The process, which I am about to describe, consists in the elimination, and possibly the oxidation, of certain impurities contained in new raw spirit by means of cold, purified air, the spirit being kept meanwhile at a temperature below 32° F., to avoid undue loss of bulk and strength. Its object is, therefore, to do away with the raw impure spirit now sold in order to supply a demand for cheap spirits, and to reduce the time necessary for producing a well-matured spirit.

Richardson, in "Medical Times," December 1869, and lectures published, 1880, on "Physiological Research on Alcohols," states that butyl alcohol is more active in its poisonous effects than the lower alcohols, and that amyl alcohol is more active than butyl alcohol. Rabuteau, in a report published at Paris in 1879 (p. 50), came to the conclusion that the evil effects of the abuse of alcohol are not due to ethyl alcohol, but to small amounts of poisonous substances occurring in so-called commercial alcohol. But he most careful and most extensive experiments on these questions have been made by the two French investigators, Dujardin Beaumetz and Audije. As a result of a series of experiments extending over three years upon pigs, selected because the digestive organs are similar to those of man, and because the pig is the only animal which willingly takes spirits with his food, Dujardin Beaumetz and Audije came to the conclusion that after treatment for thirty months only insignificant changes in the animal's organs were to be discerned, whilst when raw or badly purified spirit (whether from beetroot, potatoes, or corn) was used the animal exhibited abnormal conditions after a few months.

The French experimenters were convinced that the pernicious effects of spirit drinking were due to the slow and cumulative absorption of the poisonous impurities contained in the alcohol.

There is a demand among the working classes for a cheap spirit, and since pure matured whisky has not hitherto been procurable at low prices, this demand has been met by a blend of new, raw, patent-still spirit with an admixture of old Scotch or Irish pot-still whisky. It has been supposed by the trade that all impurities have been removed from patent-still spirit, but this is not the case.

The only remedy except selling at a commercial loss is the adoption of a ready and satisfactory process for purifying raw spirit, both patent and pot still.

Although for years past inventors have recognised the beneficial effects of air or oxygen on raw spirits no one has conceived the possibility of treating spirit for a lengthened period with a continuous stream of freely escaping air; indeed it was thought that such a treatment would result in a loss of spirit rendering the process commercially impossible. The treatment of spirit with oxygen, ozone, and air has been tried many times by different inventors, some of whom have made use of an electric current, but, hitherto, no method seems to have met with general approval, nor to have withstood the criticisms of the trade and of scientific men.

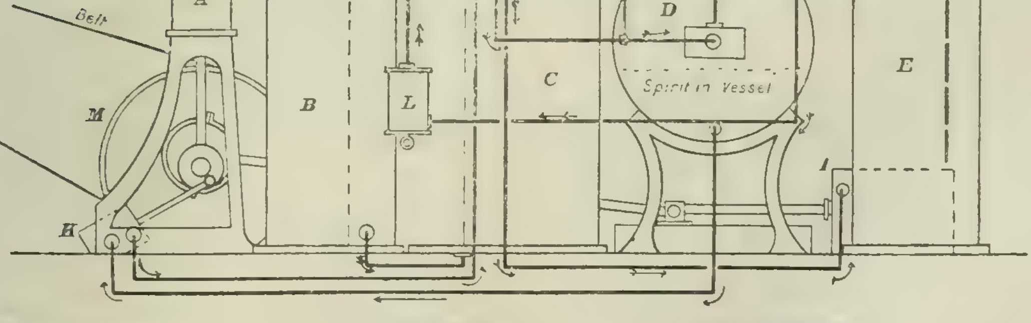
In the early experiments with the present process the analytical results (*see* Table) showed that the higher alcohols were extracted as required, but at the same time a similar proportion of the valuable ethers were removed. The plant was then altered and it was arranged to filter the air, afterwards washing and drying it before refrigeration, and this work, together with a more powerful spirit pump, gave me the power to adjust the process so as to eliminate the offensive amyl alcohol without appreciably reducing the amount of the ethers. This will be seen from the diagram of analyses, but it must be remembered that each particular whisky is a law unto itself, and that the analyses here shown are nearly all apprentice efforts at different manufactures of whisky. Second and third lots of the same whisky can always be handled more satisfactorily than first lots, that is, after we know by analysis what treatment is needed by the particular sample.

Extracts from Analyses.

—	Strength.		Higher Alcohols in terms of Amylic Alcohol.*		Ethers.*	
	Before Treatment.	After Treatment.	Before Treatment.	After Treatment.	Before Treatment.	After Treatment.
New pot still ..	16·0 O.P.	15·0 O.P.	118·0	108·9	28·9	26·8
Plant altered:						
New grain ...	11·5 O.P.	11·6 O.P.	118·0	37·0	33·3	9·6
New pot still	19·0 O.P.	17·6 O.P.	79·0	55·0	25·0	20·2
Plant altered:						
New pot still (Lowland).	8·4 O.P.	8·0 O.P.	176·0	120·0	41·0	39·5
New pot still (Highland).	10·0 O.P.	9·6 O.P.	84·0	76·0	30·5	29·4
Plant altered:						
New pot still (Irish).	21·4 O.P.	20·4 O.P.	83·0	39·0	11·9	12·2
New pot still (Highland).	10·8	10·3	198 0	142·0	36·0	35·0

* The figures are given in grains of the substance contained in a proof gallon of the spirit examined.

The process at present consists in the exposure of the largest surfaces of spirit at a temperature not exceeding 32° F. to a column of purified dry air, also at or below the freezing point, by means of a spray, the impure air after contact being allowed to escape freely to the atmosphere. We have hitherto obtained our refrigeration by the system of ammonia compression, using refrigerated brine as a vehicle to reduce the temperature of our spirit and air. Modifications of the usual brine plant serve us quite well. The air is taken through a suction box, filled with cotton wool, silk and wire facings. It is then passed through a vessel containing



A.—Ammonia compressor.
B.—Ammonia condenser.
C.—Refrigerator.
D.—Spray vessel.
E.—Auxiliary condenser.
F.—Air suction box.
G.—"Wash vessel."
H.—"Drying box."
I.—Air pump.
K.—Spirit pump.
L.—Residue vessel.
M. Belt pulley.
N.—"Stink-pot."

water and afterwards dried in what we call the snow box. The latter is an oblong airtight box, lined with block tin. Into an ammonia receiver in this box a returning cold ammonia pipe is led, and the washed air is admitted at the bottom, depositing in the form of frost in this box and on the receiver all the moisture gathered from the atmosphere and by washing. The air is then subjected to a pressure of 20 lb. by the pump, and afterwards refrigerated in a brine vessel and is ready for use. The spirit is also refrigerated by passage through a coil immersed in cold brine, and then spirit and air are violently ejected from a nozzle in the form of spray and at 20 lb. pressure into the spray vessel. This spray vessel may be of any size and shape, provided that it admits of good spraying and is air and watertight except at the recognised exits. In our present plant the spray vessel is a copper cylinder 6 ft. by 3 ft., and this would serve for a much larger plant by the adoption of certain contemplated improvements.

The spirit being below freezing point readily falls, and the air (first intercepted by baffle plates to assist in retaining the liquid alcohol) rises through filters and is allowed to escape freely into the atmosphere, carrying with it the impurities which are eliminated. Pressure is lost after spraying, the pressure-gauge on the spray vessel remaining at zero. Under no circumstance is the air containing the impurities used a second time, the cardinal point in the process being that whatever is taken out passes at once and for ever away from the spirit.

In working out the process, various points had to be safeguarded, such as cost of operation, time of operation, permanence of improvement, non-interference with the requirements of Her Majesty's excise, and loss of bulk and strength during treatment. There was a final and very important point to be watched. It was that in treating the spirit we must be careful not to eliminate anything which might prevent the whisky from further maturing in cask after treatment, or which might cause the whisky to deteriorate subsequently in cask. I will (very shortly) take the points in this order.

We are now working at a fraction over $\frac{1}{2}d.$ per gallon cost of gas and condensing water. The engineers estimate that larger plant can be worked at half this figure. One working engineer and two assistants could handle a plant treating 10,000 galls. per day. Four hours' actual work at 20 lb. pressure is sufficient for almost all whiskies. That the result is permanent all our demonstrations from the very first have united to prove.

The excise authorities require that newly-made spirits shall go from the still into bond within a given time. In working at a distillery we can if necessary comply with all requirements, while in ordinary blending bonds the process will blend perfectly and clean at the same time (all within the usual racking allowance for loss).

Her Majesty's excise have watched the process from the start, and their officers have with uniform courtesy and kindly feeling encouraged my work. The small loss by the process (inside $1\frac{1}{2}$ per cent. bulk and strength) is at the root of their goodwill. We have worked in bond for many months under indulgences from Somerset House several times renewed, and I possess records carefully arrived at by Her Majesty's excise officers confirming the small loss by the process.

The final and most important consideration from a trade point of view is whether in this process anything is taken out which would cause the spirit to deteriorate after treatment. The answer from practical tests is a negative one. Samples of spirit treated by the earliest plant prove that no harm whatever is done to the spirit by the process, and, moreover, the spirit continues to mature much more quickly after treatment than before. The process does not claim to absolutely mature spirits, but to clean them, and the cask may be used to advantage to finish off the work. It is a curious fact that prolonged treatment of six-year-old spirit by the process, shows neither improvement nor loss according to analysis, but only an added softness or roundness. I put this forward as a proof that the process is merely a natural hastening of the work done in cask, genuine six-year-old whisky being a good and wholesome article. New whisky treated in the way I have described, and blended with 15 to 20 per cent. of old Scotch or Irish, has been in consumption without comment or complaint for many months at various Liverpool spirit establishments.

Discussion.

Dr. Kohn said that the discovery of Mr. Scott was one of great interest to chemists, especially in regard to that somewhat unknown product called fusel oil. The analytical results went to show that by the treatment of spirit with cold purified air, the proportion of the alcohol they wanted was not appreciably reduced, whilst the alcohols which they did not want were very markedly decreased. The fact that this was affected by a process in which the products removed were not again brought into contact with the treated spirit seemed the point where Mr Scott had scored over previous processes. Another point of special interest seemed to be the fact that according to Mr. Scott's statement there was no interference with the subsequent maturing of the whisky. From a chemical standpoint that was difficult to understand. Those products which were injurious in raw whisky seemed to be the products which helped in the subsequent maturing of whisky, and they were eliminated to a considerable extent by this treatment, still the whisky went on maturing as if they had not been removed. It seemed to him that Mr. Scott had placed a process at their disposal which allowed of the investigation of those products which were injurious in raw whisky, namely, the contents that were collected in and evolved from the stink-pot. From the chemist's standpoint he should regard the stink-pot as by far the most interesting portion of the whole apparatus. The products there if collected and examined would probably give a most important key to the chemistry of the whole subject.

Mr. Alfred H. Allen said he regarded Mr. Scott's process as remarkable, and one which furnished food for a very great deal of thought. Although he had given some attention to the chemistry of whisky, and especially in connection with this process of Mr. Scott's, he was very far from understanding more than the first principles involved. The fact was that there existed in whisky a number of subsidiary constituents which affected the taste and probably the wholesomeness of the spirit. Unfortunately these existed in such small quantities that it was with the utmost difficulty they could get indications of their presence, while in most cases their determination was impossible. Personally he had attempted to see whether all the terrible things said about fusel oil were true, and for three weeks he had added 2 per cent. of fusel oil to his nightly glass of whisky. He did not think he ever tasted anything so horrible in his life. It was intensely nauseous, but it did not give him a headache. They had reason to know that the higher they went in the alcohol series—as the experiments of the French chemists had shown—the more injurious they became. The term "fusel oil" was a very comprehensive one. The composition was extremely complex and varied materially with its origin, the fusel oils from grape-spirit, potato-spirit, and grain-spirit all having distinct characters. To further complicate the matter, the fusel oil of pot-still whisky was not eliminated in the process of manufacture, and probably no one had ever seen a pint of it. The most tangible constituent of fusel oil was amylic alcohol, but there was a good deal of butylic alcohol as well. He was inclined to think they might go too far in eliminating the higher alcohols from whisky, and he considered it was rather an advantage in Mr. Scott's process that he did not succeed in getting them all out. There seemed to be some limit as to the extent to which the amylic alcohol could be brought down, as his analyses showed that the spirit after treatment always retained something like 40 grains per proof gallon of higher alcohols. Previous inventors, who had worked above the freezing point of water, could not afford to allow the air to escape after use because it took so much alcohol with it. Hence they were obliged to employ the same air repeatedly, thus restoring to the spirit any impurities previously removed. Mr. Scott hit on the idea of working below the freezing point, and had established the interesting, and he believed novel, fact, that alcohol was practically non-volatile below the freezing point of water. It was consequently possible to use the air once only, and then allow it to pass right away. However, he did not think that fact alone would have rendered the process successful. In the first place, he profoundly doubted whether any oxidation took place so far as the higher alcohols were concerned. On the other hand, there were other constituents present which probably played a much larger part in this cleaning process than at first appeared. For instance, furfural existed in all new pot-still whisky, and furfural was a substance which was capable of ready oxidation. As to the stink-pot, it would be exceedingly interesting from a chemical point of view to know what the products were which escaped through it. These were not merely amylic alcohol; the water contained a trifle of alcohol and some fusel oil, but there was nothing definite or characteristic in its smell which would enable one to say what passed off or was condensed by that water.

London Section.

"VELVRIL" MATERIAL: A NEW SUBSTITUTE FOR INDIA-RUBBER AND GUTTA-PERCHA.

BY W. F. REID, F.I.C., F.C.S.

(This Journal, 1899, 972—977.)

Errata.

In Mr. J. Cardwell Quinn's remarks in discussion on p. 976, col. 2, in line 12, for "90 per cent. of guncotton" read "90 per cent. of castor oil"; in line 20, for "electrical conductivity" read "dielectric strength"; and from the words "in fact" on line 22 down to "matter" on line 23, read "then, side by side with the question of cost, there was the most important matter of tensile strength."

Meeting held on Monday, December 4th, 1899.

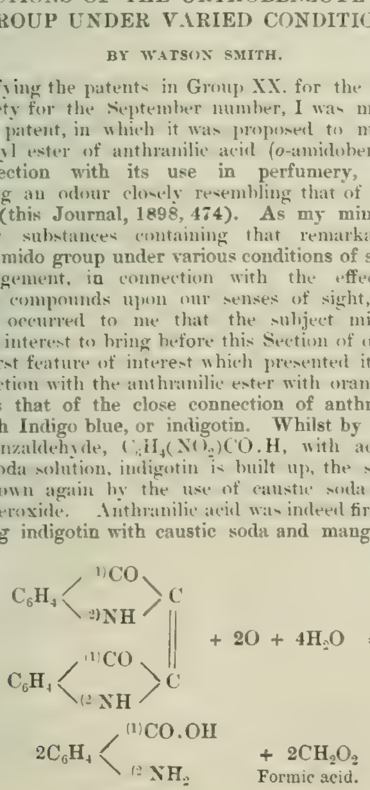
MR. OTTO HEHNER IN THE CHAIR.

FUNCTIONS OF THE ORTHOBENZOYL-IMIDO GROUP UNDER VARIED CONDITIONS.

BY WATSON SMITH.

In classifying the patents in Group XX. for the Journal of our Society for the September number, I was much struck with one patent, in which it was proposed to manufacture the methyl ester of anthranilic acid (*o*-amidobenzoic acid) in connection with its use in perfumery, this body possessing an odour closely resembling that of the orange blossom (this Journal, 1898, 474). As my mind reverted to other substances containing that remarkable ortho-benzoyl-imido group under various conditions of substitution or arrangement, in connection with the effects of the resulting compounds upon our senses of sight, smell, and taste, it occurred to me that the subject might be of sufficient interest to bring before this Section of our Society.

The first feature of interest which presented itself to me in connection with the anthranilic ester with orange-blossom odour, is that of the close connection of anthranilic acid itself with Indigo blue, or indigotin. Whilst by the use of *o*-nitrobenzaldehyde, $C_6H_4(NO_2)CO.H$, with acetone and caustic soda solution, indigotin is built up, the structure is pulled down again by the use of caustic soda and manganese peroxide. Anthranilic acid was indeed first obtained by boiling indigotin with caustic soda and manganese peroxide.



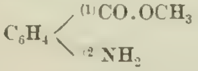
$$\begin{array}{l} C_6H_4\left\langle\begin{array}{l}^{1)}CO\\ ^{2)}NH\end{array}\right\rangle C \\ \qquad\qquad\qquad\ \| \qquad + 2O + 4H_2O \ = \\ C_6H_4\left\langle\begin{array}{l}^{(1)}CO\\ ^{(2}NH\end{array}\right\rangle C \\ 2C_6H_4\left\langle\begin{array}{l}^{(1)}CO.OH\\ ^{(2}NH_2\end{array}\right. \qquad + 2CH_2O_2 \end{array}$$

Anthranilic acid. Formic acid.

I think, then, we shall not be guilty of exaggeration if we interpret the above decomposition of indigotin as one in which the first motion of the caustic soda and nascent oxygen may be regarded as one tending to oxidise, break up, and remove the $-C = C-$ group as $2(CH_2O_2)$, leaving two anthranil groups, which immediately under the influence of caustic soda, form anthranilic acid and then its sodium salt. Turning now to the process proposed for making the methyl anthranilate, the chemists of the Berlin-Actiengesellschaft, or inventors, in patents taken out for England by Mr. C. D. Abel, Eng. Pat. 19,868 of 1898, and 75 of 1899 (this Journal, 1899, 856, and 1051), point out that G. Schmidt (J. f. prakt. Chem. 2, 36, 374) obtained a yellow liquid which he took to be a methyl ester of *o*-amidobenzoic acid, but as Schmidt makes no mention of any odour characterising his substance, they regard the fact as a proof that he never obtained the ester in question. I may mention that the ortho-ethyl ester is described and formulated in Beilstein's Handbook for 1888, but no reference is made to its odour, or to the methyl ester.

The inventors prepared the methylic ester in a pure state and in quantity, as follows:—

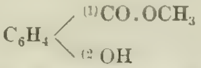
A solution in 5 litres of methyl alcohol of 1 kilo. of anthranilic acid, was saturated under an inverted condenser, with gaseous hydrochloric acid. The formation of the methyl ester is accompanied by a considerable rise of temperature in the mixture, which at last begins to boil. It is let stand for some time and then the larger portion of the alcohol is distilled off on the water-bath. By adding solution of Na_2CO_3 to the residue, the new ester is separated out as an oily liquid, which is washed with water and then distilled *in vacuô*, the methylic ester being obtained, of the formula—



$$C_6H_4\left\langle\begin{array}{l}^{(1)}CO.OCH_3\\ ^{(2}NH_2\end{array}\right.$$

It forms colourless crystals exhibiting blue fluorescence, which melt at 23°·5 C., and which distilled in a partial vacuum (under a pressure of 11 mm.), boil at 127° C. The ester dissolves easily in mineral acids, in alcohol, ether, &c., but only sparingly in water. All its solutions exhibit the beautiful fluorescence already referred to. (See also this Journal, 1899, 604; also 1898, 1174.)

The Carboxymethyl group is in effect itself an aromatophoric group, and its function is demonstrated in the benzoic acid methyl ester $C_6H_5.CO.OCH_3$ and the salicylic acid methyl ester—



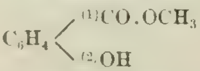
$$C_6H_4\left\langle\begin{array}{l}^{(1)}CO.OCH_3\\ ^{(2}OH\end{array}\right.$$

but the amido group existing in the anthranilic acid methyl ester contributes essentially to the production of the scent peculiar to that ester, which scent is not entirely different from those of already known amidised esters.

Again, all the following bodies are perfumes, each with its particular flavour:—

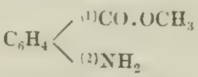
$C_6H_5.COH$
Benzaldehyde.

$C_6H_5CO.OCH_3$
Methyl benzoate.



$$C_6H_4\left\langle\begin{array}{l}^{(1)}CO.OCH_3\\ ^{(2)}OH\end{array}\right.$$

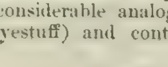
Methyl salicylate.



$$C_6H_4\left\langle\begin{array}{l}^{(1)}CO.OCH_3\\ ^{(2)}NH_2\end{array}\right.$$

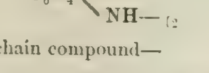
Methyl anthranilate.

Thus far we have considered (1st) the closed-chain compound indigotin (in which the peculiar carbon group $=C = C-$ offers considerable analogy to the $-N = N-$ group in an azo-dyestuff) and containing the *o*-benzoyl-imido group—



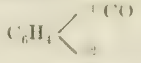
$$C_6H_4\left\langle\begin{array}{l}CO-^{(1)}\\ NH-_{(2}\end{array}\right.$$

(2nd) The open-chain compound—

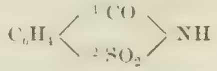


$$C_6H_4\left\langle\begin{array}{l}CO.OCH_3 \quad ^{1)}\\ NH_2 \qquad\quad ^{2)}\end{array}\right.$$

also containing this group, though in different relationship, and now (3rd) we approach another variation of this group and of great interest, since in this, the sense of taste is powerfully affected; I refer to saccharin, in which the NH group is brought into close juxtaposition with the CO group of the following nucleus:—

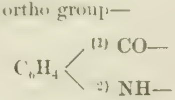


and the sulphonic group, SO_2, has been introduced in the ortho position to this CO group, so as to take the place vacated by the NH group, and forming as a whole—

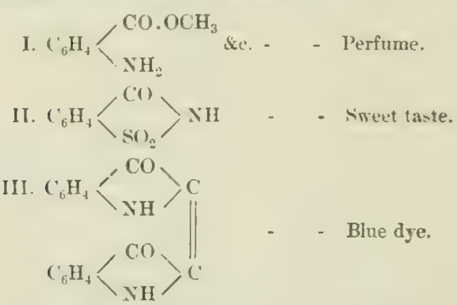


i.e. benzoyl sulphonic imide or "saccharin."

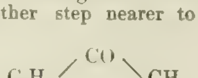
The wisdom of this interposition, if I may so term it, rests on the fact that whereas in benzoylamido or imido compounds there is liability to decompositions in which aniline may be formed and separated, with toxic effect if in the stomach or organism, such formation and separation are impossible in the position now accorded to the NH group. We may finally arrange the bodies considered as derivatives of this remarkable ortho group—



under three heads, as affecting powerfully, as well as agreeably, three of our five senses—

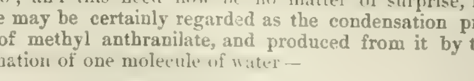


Since writing the foregoing, I see in Berichte, **32**, [14], 2611 (this Journal, 1899, page 1153), that Hesse has discovered indole in the essential oil of jasmine flowers, and he states that it is also present in the essential oil of orange blossom, in both cases along with methyl anthranilate. Since indole is another step nearer to indigotin than anthranil, being—



the interpretation referred to in the second paragraph of this paper, is proved to be a rational one. It would even seem possible that, under certain conditions of climate and cultivation, some indigo might be formed in plants yielding the essential oils referred to; for, according to von Baeyer's view, indole is the mother substance of Indigo.

But I further observe (this Journal, 1899, page 1118) that a patent has just been taken out by Meister, Lucius und Brüning, for producing indigotin by reducing a mixture of ethyl acetonyl anthranilate and ethyl- or methylanthranilate in benzene solution with sodium, acidifying, and then treating with caustic soda. Thus, the odoriferous methylanthranilate can be directly used for the preparation of Indigo; and this need now be no matter of surprise, for indole may be certainly regarded as the condensation product of methyl anthranilate, and produced from it by the elimination of one molecule of water—



We may then perhaps summarise as follows:—Anthranilic acid, itself having a sweet taste (of no service however), appears to be a substance which is linked in a remarkable manner on the one hand, through its relationship to indigotin, to the dyestuffs, and on the other, through its methyl ester to perfumery, both dyestuff and perfume essence being also of vegetable origin, whilst in anthranil, by a slight variation through the introduction and interposition of the $-SO_2-$ group, an intensely sweet substance, saccharin, is produced, useful in medicine and dietetics, and having no liability to decompose in the organism so as to yield aniline and thus become toxic.

Discussion.

The **Chairman** invited discussion of Mr. Watson Smith's paper, and suggested that both the theoretical and the practical sides of the question might be discussed.

Dr. J. Lewkowitsch wished to ask Mr. Watson Smith whether the same product had not been put into the market several years ago by Schimmel and Co. as artificial neroli oil, so that although the claim might have been patented in England, it was not a new discovery.

Dr. F. B. Power said that there were several points raised by the paper which might be subjects of controversy, and which could not be entered upon that evening. He took it for granted that Mr. Watson Smith was aware that the methyl ester of anthranilic acid was not a new body. The artificial oil of neroli, of which it was a constituent, was prepared by Schimmel and Co., of Leipzig, about six years ago, and brought into commerce by them in 1895. With regard to the fluorescence spoken of, he might say it had been known for a very long time that the natural oil of orange flowers exhibited a bluish fluorescence, especially in alcoholic solution, but it was not known to what this was due until Schimmel and Co. discovered methyl anthranilate in the oil. Since that time other German chemists had worked on the subject, but although Schimmel and Co. did not take out any patents, they had in 1895 deposited papers with a notary at Leipzig, with date and signatures attached, and were thus able to prove the priority of their discovery. It was not alone the methyl ester of anthranilic acid which gave to neroli oil its peculiar fragrance and highly esteemed qualities as a perfume, although it was an important constituent. Tiemann and Semmler had shown some years ago that neroli oil also contained a large amount of linalool and geraniol, or the esters of these alcohols.

The **Chairman** wished to thank Mr. Watson Smith for his paper. Even if his compound was not quite new it reminded them of the many organic substances which came to them from abroad. Much had been done in the elucidation of the question as to what the colour of a substance was due, but practically nothing had been done in the way of investigating the cause of odour. It seemed at present impossible to draw any broad line or formulate any plausible theory from which to explain odour. They had organic substances, esters, nitrocompounds, aldehydes, hydrocarbons, &c., of the most multitudinous composition, which possessed odours and which were the main constituents of the most prominent essential oils. The subject was well worthy of investigation, especially as lately the artificial manufacture of odoriferous materials had become of great prominence.

Mr. Watson Smith, in reply, said that he had never heard of the body having been manufactured before. With regard to Dr. Power's remarks, these formed of themselves an interesting communication; he himself had devoted most of his attention to theoretical considerations tending to establish certain relationships. He thought it would be noticed that the anthranilate was more aromatic than sweet in odour, and Dr. Power's remark as to some other body communicating sweetness to the natural product would explain this.

THE FIREPROOFING AND PRESERVING OF TIMBER.

BY SHERARD COWPER-COLES.

The rendering of wood non-flammable has received the attention of engineers and inventors for a considerable time, but it is only of late years that practicable methods have been devised. Wood can now be rendered sufficiently fireproof to resist the temperature of a Bunsen flame, which, according to the most recent measurements, is 1820° C. ("American Electrician." *See* "Engineer," Aug. 11th, 1899.) It is essential that the fire-resisting treatment should permeate to the heart of the wood, so as to render it internally as well as externally fireproof. In getting rid of the combustible elements from the wood cells, and substituting the fireproofing material, great care should be exercised not to rupture their delicate structure, and so deteriorate the value of the timber, special care must be taken when preparing ash, as the cells very readily collapse. This is probably due to the fact that ash has a very broad sapwood, a property which is peculiar to it. According to Prof. H. Marshall Ward, the sapwood comprises about 40 annual rings, and there is no difference between the first formed and the later or outer layers.

Best Condition of Wood prior to Treatment.—Before commencing to fireproof wood, it is of importance to know if it was hewn in winter or summer. It is well known that timber cut down in summer represents a lower value than that felled in winter. Timber hewn down during the resting period, *i.e.*, between October and April, contains in its cells numerous starch particles which cannot be found in wood cut down in summer. Owing to this presence of starch, the wood is coarse and impenetrable, since the starch closes the pores. For this reason, winter-hewn timber is exclusively employed for staves, because with staves from summer-hewn wood, the contents of the barrels are subject to evaporation through the pores. The starch contained in the winter wood is given a violet colour by iodine. Hence, if the timber to be examined is coated with an iodine solution, and the surface of the felling side appears yellow, it may be assumed with certainty that the respective tree was cut down in summer. The light yellow lines are the moisture rays, while cells, tissues, and wood fibres simply take on a yellow colouring. In the case of winter-hewn timber, the amylaceous rays form much darker ink-coloured black strips on the yellow ground.

In most cases sapwood is useless for external purposes, but can be rendered more useful by injecting chemicals to prevent albuminous fermentation and the growth of parasitical vegetations. A number of tests made by Drude, tend to prove that steaming wood before impregnating it with solutions tends to lessen its absorption powers, and that therefore it should be as dry as possible. The author's experience is, that it is almost impossible to force the fireproofing solution in unless the wood is steamed—in the case of soft woods, for about four hours, and in the case of hard woods, for two or three days.

Simpson has found that oak, if exposed long to the action of steam at a high temperature, is very apt to warp and crack. Soft woods, such as deal, pine, ash, and the like, are apt to become discoloured under the same conditions, whilst teak, mahogany, and pitch pine will stand more steaming without deterioration.

The difference in time required to impregnate various woods is very considerable, which will be readily understood by examining their structure.

The medullary cells no doubt carry the impregnating solution to a certain degree, as in oak casks it is found necessary not to have the medullary cells passing from the inner face of the stave to the outer face, as the casks will not then hold liquor. It has been estimated that green wood, when cut down, contains about 45 per cent. of its weight in moisture, and in the forests of Central Europe, wood cut down in winter is said to hold 40 per cent. of water until the end of the following summer, and if kept in a dry place for several years, to contain 15 to 20 per cent. of water. Wood that has been thoroughly desiccated, when exposed under ordinary circumstances, absorbs about 5 per cent. in the first three days and will continue to absorb it until it reaches 14 to 15 per cent.

Hydroscopically absorbed water, according to Prof. H. Marshall Ward, ranges from 50 to 90 per cent. of the volume of the solid wood substances, according to the species and some other circumstances.

The greater portion of the water in green wood is driven off at a summer heat 25° to 30° C., this is the water of the "Sap," and is held by capilliary attraction in the cells of the wood; the remainder is "imbibed" water, which is held in the walls of the cells and is only displaced by heating the wood at a temperature above that of boiling water for several hours. Steaming or boiling unseasoned timber will fit it quickly for use, but it takes from its strength.

The following analyses of various woods have been made by Chevandier (Ann. Chim. Phys. (3), 10, 129):—

——	Carbon.	Hydrogen.	Oxygen.	Nitrogen.
Beech	49·89	6·07	43·11	0·93
Oak	50·64	6·03	42·05	1·28
Birch..........	50·61	6·23	42·04	1·12
Aspen	50·31	6·32	42·39	0·98
Willow	51·75	6·19	41·08	..

Although hydrogen and oxygen are contained in a woody fibre in the same proportion as those in which they unite to form water (1 to 8) this relative proportion is not accurately observed in different woods, the hydrogen being often contained in them in larger and variable quantities.

The composition of different woods does not vary, however, so much as might be anticipated. As a general result ordinary air-dried wood may be considered as being composed of 20 per cent. hydroscopic water, 40 per cent. oxygen and hydrogen in the proportion in which they unite to form water, 40 per cent. charcoal containing 1 per cent. of ash. Heated from 120° to 140° C. the wood loses its hydroscopic water and becomes kiln dried, and then contains 50 per cent. of oxygen and hydrogen in the proportions in which they combine to form water, and 50 per cent. charcoal containing 5 per cent. of ash.

The following determinations of the specific gravity of various woods have been made by Karmarsh. (Chemical Technology. Vol. I. Groves and Thorp.)

Specific Gravity (Mean Values).

Name of Wood.	In the Green State.	In the Air-dried State.	Mean Weight of 1 Cubic Foot of Air-dried Wood in 1 lb.
Maple	0·893	0·697	37
Birch	0·919	0·713	38
Red Beech	0·980	0·771	41
White Beech	1·038	0·759	40
Box	..	0·971	52
Cedar	..	0·568	30
Ebony..............	..	1·259	67
Oak	0·973	0·785	42
Ash	0·852	0·692	37
Pine...............	0·920	0·467	25
Larch	0·809	0·565	30
Lime	0·794	0·581	31
Poplar.............	0·857	0·487	26
Silver Fir..........	0·894	0·622	33
Elm	0·909	0·519	33

The true specific gravity of all woods is 1·56.

Fireproofing.—An ideal fireproof wood should possess the following qualities:—

1st. Its weight should not exceed greatly that of untreated wood.

2nd. Its strength should not be diminished in the process of fireproofing.

3rd. It should not corrode metals when placed in contact with them.

4th. It should not contain soluble salts.

5th. It should not contain deliquescent salts.

6th. It should not contain crystals or hard particles which will blunt tools.

7th. It should take paint and be capable of being polished.

8th. It should not be discoloured in the process. It is doubtful whether any of the processes at present in use give a product possessing all these qualities, leaving aside the all-important factor of cost which renders some of them even if efficient, quite impracticable for ordinary purposes.

About 50 years ago a number of processes for rendering timber or fabrics fireproof were tried on the Continent and in 1841 Payne introduced a process which consisted of enclosing the wood to be treated in a closed iron vessel, exhausting the air, and allowing a solution of sulphate of iron to flow in. This thoroughly permeated the parts of the wood, after which a solution of muriate of lime was added, the double transference of these chemical compounds then took place, making sulphate of lime or gypsum and muriate of iron, the result being that the pores of the wood were filled with gypsum.

Zinc-Gypsum Process.—A zinc-gypsum process has also been tried in America. It was claimed that the gypsum crystallised in the cells of the wood, thus stopping them up, and preventing the zinc from being washed out.

Thilmanz Process.—This process consists of injecting a solution of sulphate of zinc or copper, followed by a second injection of chloride of barium, so that a chemical change may take place in the wood ducts, the chloride of barium being changed into an insoluble salt, sulphate of baryta, its chlorine forming chloride of zinc or copper, the object of the insoluble salt is to prevent the soluble one from being washed out.

Willhouse or Zinc Tannin Process.—In this process a solution of zinc chloride containing a small quantity of glue is injected, and then a solution of tannin; the effect of the tannin being to form small particles of artificial leather insoluble in water, which are supposed to plug up the ducts and retain the zinc chloride.

Hexamer's Process.—Dr. Hexamer has come to the conclusion that the best results are obtained with gelatinous silica, precipitated with ammonium chloride.

Pepper's Process.—Prof. Pepper, after a series of careful experiments, determined that phosphate of ammonia gave excellent results.

Hely's Process.—Hely has proposed impregnating wood with a strong solution of calcium bisulphite, and then with a solution of caustic lime, so as to form a monosulphite which is subsequently oxidised by the action of the air to calcium sulphate, which is said to become practically part of the ligneous structure.

Another process has been patented for forcing a solution of dibasic or tetrabasic phosphate of lime and sulphurous acid into wood (from which the air has been exhausted) at a pressure of six to eight atmospheres for about two hours. The wood is dried in a heated enclosed space to admit the recovery of the escaping sulphurous acid.

Boudin and Donny's Process.—Messrs. Boudin and Donny conducted a number of experiments at Ghent University, with various fireproofing processes, but arrived at no very definite conclusions, though they say that the possible diminution of strength, due to all injection processes, must be taken into account, and all such substances as chloride of calcium, and other deliquescent substances must be rigorously avoided. They found phosphate of ammonia, on the whole, to give the best results. Good results are said to be obtained with ammonia and sulphate of lime, the action of this mixture of salts, depending on the incrustation of the fibres; and the volatilization of the salt of ammonia which assists in extinguishing the flame. When injection processes cannot be employed, Messrs. Boudin and Donny recommend the application of cyanide of potassium and asbestos paint ("Workshop Receipts," 5th series). The following treatment is said to render wood incombustible without altering its appearance:—

	Lbs.
Sulphate of zinc	55
Potash	22
Alum	44
Oxide of manganese	22
Sulphuric acid of 60° (Twaddel)	22
Water	54

All the solids are poured into an iron boiler, containing the water at a temperature of 113° F. As soon as the substances are dissolved, sulphuric acid is poured in little by little until all the substances are completely saturated. The wood is boiled for three hours in this mixture, and then dried in the open air.

Gunn, of Bristol, has taken out a patent for the use of cresylate of either mercury, lead, copper, iron, or zinc. 100 parts of cresol are heated at a temperature between 80° and 100° C., with 120 parts of the oxide of any of the above metals, until a drop of the substance solidifies on cooling.

Alberto Issel's Process.—Issel, of Genoa, has patented a composition for rendering wood incombustible. The composition consists of a solution of stated proportions of boric acid and potash alum, and in the case of resinous woods, boric acid, oxalic acid, and potassium carbonate.

Leboida's Process.—Leboida has taken out a patent for an apparatus which embodies an injector, by means of which wood can be impregnated with solutions without the necessity of boiling, which is said to ruin the texture of the wood. The apparatus consists of a compressing chamber and a suction chamber, which are superposed, but separated by a perforated platform.

Gustave Dime's Process.—Gustave Dime uses a solution composed of chloride of ammonium 15 parts, and microcosmic salt one part, to which in some cases he adds one part borate of sodium or potassium.

Simpson's Process.—A company is now at work, both in America and England, fireproofing wood for use in the construction of warships, and for many other purposes.

Works have recently been erected at Wandsworth Bridge, Fulham, and are equipped for rendering indestructible by fire large quantities of material by the American process.

The wood to be treated is placed in cylinders, where, after its volatile and fermentable constituents have been given off, a fireproofing solution composed largely of phosphate of ammonium is applied, under a pressure of 200 lb. per square inch. This operation takes about four hours. The timber is next dried in a drying room supplied with hot air, where it remains for a fortnight or more, after which it is ready for use. Treatment with methylated spirit for the extraction of soluble matter previous to impregnation has been patented by this company.

The cylinders in which the wood is placed are 7 feet in diameter, and 35 to 75 feet long, the longest being 105 feet. The timber for treatment is stacked on small steel trucks which are run into cylinders. Mr. Douglas Fox, in a paper read before the last meeting of the British Association, stated that wood treated by the American process is not such a good conductor of heat as untreated wood. If a Bunsen burner is placed under a sample of treated wood one inch thick, and a few grains of gunpowder placed upon the upper surface some hours will elapse before sufficient heat will pass through the wood to ignite the powder. Fireproof wood should therefore be very useful for protecting magazines.

Mr. Fox also stated that the length of time required to melt a given quantity of ice in treated and untreated wooden boxes subjected to similar conditions, had also been investigated, the result showing that the ice lasted double the length of time in the treated box.

It is found that fireproof wood has a tendency to slightly corrode metal fittings, is somewhat heavier and harder to work than untreated wood, does not wear well, and absorbs water. Its retention of water and the effect of alternate wetting and drying, is said to be very marked, and has been made the subject of a series of special tests. The fireproofing chemicals are found to wash out, or in some way to be destroyed, so that the wood becomes as combustible as ordinary timber, and in certain ways even more so.

A series of experiments has recently been conducted in the United States by the Assistant Secretary of the Navy, which seems to indicate that wood preserved by the present known methods must be limited to internal fittings.

The disadvantage attending the use of ammonia compounds as regards corroding structures or objects that may come in contact with the wood is said to be overcome by adding hydrates or oxides of certain metals, so as to form double salts and kill any free acid. The salts of zinc seem to be the ones most commonly used.

The author has experimented with solutions of the following salts, of various strengths and combinations:—

Stannous chloride, ammonium phosphate, ammonia alum, ammonium chloride, iron alum, sodium phosphate, zinc chloride, sodium aluminate, sodium tungstate, sodium plumbite and silicate, sodium stannate, sodium sulphate, manganese sulphate, zinc sulphate, copper sulphate, borax and aluminium sulphate, ammonium sulphate, ferrous sulphate, calcium sulphate, potassium bichromate, and zinc hydrate in excess of caustic soda, and in excess of ammonia. Most of these salts or combinations of salts in practice would be too expensive. The solutions containing free acid were found to char the wood, those containing alkali made it very brittle on drying.

The plant used for fireproofing the specimens on the table consists of a steel cylinder, where the wood was steamed for times varying from a few hours to several days, according to the nature of the wood. The cylinder was then exhausted so as to form a vacuum of about 28 inches, for about half the time usually required for steaming. The fireproofing solution was next run into the cylinder and allowed to remain for about 12 hours without pressure, and for about 24 hours at about 300 lb. pressure, but these conditions are greatly varied according to the variety of the wood and the conditions in which it is received.

To test the hydroscopic character of wood treated by this process, a weighted quantity of thin dried wood was exposed to air saturated with moisture at a summer temperature for 18 hours, and was found to absorb less than three parts of water per cent. of its original weight. The wood is therefore, if anything, less hydroscopic in character than ordinary untreated wood.

Nodon-Bretonneau Process.—A model plant for seasoning wood by means of electricity is now in operation at Messrs. Johnson and Phillips' works at Charlton, the system used being the Nodon-Bretonneau. The timber to be seasoned is placed in a large tank and immersed, all but one inch or so, in a solution containing 10 per cent. borax, five per cent. resin, and three quarters per cent. sodium carbonate. The lead plate on which it rests is connected to the positive pole of the dynamo, the negative pole being attached to a similar plate arranged on the upper surface so as to give good electrical contact, the circuit is completed through the wood.

Under the influence of the current, the sap appears to rise to the surface of the bath, while the aseptic borax and resin solution takes its place in the pores of the wood. This part of the process requires from five to eight hours for its completion, and then the wood is removed and dried, either by artificial or natural means. In the latter case a fortnight's exposure in summer weather is said to render it as well seasoned as storage in the usual way for five years.

The current is supplied at 110 volts, 18 ampères per hour per cubic foot of timber being used; the greener the wood the better, because its resistance is less. The liquid in the bath is kept at a temperature of from 90° to 100° F.

Taking the cost of electrical energy at 1*d.* per kilowatt, the cost of treating by this process, without considering the drying question, works out at less than one-fiftieth of a penny per cubic foot. Those who are introducing the process into this country do not profess to give a complete explanation of its "rationale," though they describe it generally as a case of "electro-capillary attraction," but they claim that its results are satisfactory, however surprising it may seem. They even state that some woods, such as the "Maritime Pine," of the South of France, which cannot now be properly dried, will after their treatment be found useful and serviceable.

Hasselmann's Process.—Herr. Hasselmann, of Munich, has devised a method of preserving wood sleepers, which is stated to have been used with success on the Bavarian State Railways.

His object was to produce a chemical union of the substances of the wood and preservative. The process consists in the double baking of the wood, and the treatment with oil of vitriol and sulphate of iron. It is afterwards placed in a bath of chloride of lime, to which milk of lime has been added, at a temperature of 100° to 125° C. with a pressure of 40 lbs. per square inch. The first baking destroys the germs of fermentation, and induces the mechanical union of the preservative with the fibres of the wood. The second hardens the wood, and so changes its character that it remains dry even when left in damp places. The whole process takes about six hours, and the cost is stated to be exceedingly small.

Table of Specific Gravities and Strengths of Woods.

Wood.	Specific Gravity.	Tearing Force lb. sq. in.	Crushing.	Breaking.*
Lignum Vitæ	1·333	11,800	..	..
Ebony	1·193	..	18,960	27,280
Box	0·960	20,000	10,300	..
Oak	0·934	10,000	10,060	10,030
Mahogany (Spanish)	0·853	21,800	8,200	7,560
Ash	0·753	17,000	9,000	12,200
Deal	0·698	12,400	6,590	..
Beech	0·690	11,500	9,360	9,340
Walnut	0·671	8,460	7,230	8,800
Pitch pine	0·660	7,820	5,400–6,800	9,790
Teak	0·657	12,460	12,100	14,770
Sycamore	0·590–690	13,000	..	9,360
Mahogany (Honduras)	0·560	..	..	11,480 Baywood.
Elm	0·544	13,490	10,330	6,080
White pine	0·460	..	5,440	11,830
Deal	0·340	17,600	7,290	..

*18 × weight in lb. in middle of bar 1 sq. in., 12 in. span = greatest tension in beam.

The following figures were obtained in practice, and must only be taken as approximate:—

Decrease in Weight on treating various Woods with Methylated Spirits.

Name of Wood.	Before Treatment.		After Drying.		Percentage. Reduction in Weight.
	lb.	oz.	lb.	oz.	
English elm	2	4¼	2	4	0·68
American elm	2	0	1	3½	7·8
American oak	1	9¾	1	7¼	9·70
Ash	2	13¼	2	8½	10·27
Birch	2	11	2	3¼	16·80
Beech	3	6¾	2	13	17·80

DISCUSSION.

Dr. S. **Rideal** remarked that he did not quite understand the reason for the experiment which the author had made with the samples of fireproofed wood immersed in water. The piece of blue gum wood seemed to have sunk, but the other samples had not. He did not know whether temperature had any effect on the comparative density of wood; but he had been reading a paper on the Soudan, from which he learned that there were large forests of ebony and acacia in that region which were practically worthless, it being impossible to get the wood down to the seaboard, as it would not float.

Mr. **Sayer** explained that the experiment was to show that the gravity of all true wood was about 1·56 after the imbibed water and air had been removed. They boiled some samples in a concentrated solution of zinc sulphate to drive out the air and imbibed water, and they then found that the gravity of all the samples was practically 1·56. They had tried to show that in the experiment put before the meeting, but the samples had not been boiled long enough. The air dried blue gum sank in water without this boiling and ebony would have done the same.

Dr. **Rideal** continuing, said that American walnut or hickory had a sap wood and a heart wood. The latter was used for the manufacture of furniture, and lately, in order to increase the yield of marketable wood, the sap wood had been impregnated with dyestuffs in such a way as to render it indistinguishable from the heart wood. In that way a great amount of wood had been imported to this country which, when used by the cabinet maker, produced worthless furniture. He believed that the sap wood was impregnated in a similar way to that which the authors had described as being used for introducing the fireproofing fluids.

Mr. **Watson Smith** thought it might be interesting to hear something of a practical nature as to what had been the outcome of the fireproofing of wood, and he could tell the meeting what was done at the Manchester Royal

Jubilee Exhibition (1887). In that exhibition the mixture adopted for fireproofing materials was one of a solution of sal ammoniac and boric acid, neutralised with ammonia. All they attempted to do was to saturate the light articles, flooring, matchwood, and hangings employed in the building itself. There were no less than ten outbreaks of fire during the exhibition, he learnt subsequently; and the chief of the Manchester Municipal Fire Brigade, when asked by the magistrate, in a case in which he had made this statement, how he accounted then for the fact that no fire was ever heard of during the exhibition period, and that no losses were incurred, stated that though these fires started, "they soon found that there was nothing to get hold of, for the things were fireproofed." He meant that the light articles which were likely to take fire first, and on which the conditions of a conflagration rested, were fireproof, and as they resisted the flame, the heavier timbers were naturally safe.

Mr. E. **Grant Hooper** asked if the reader of the paper could say whether the compound finally adopted for fireproofing wood was phosphate of ammonia. The paper mentioned many processes in which various chemicals had been employed, but it did not clearly express whether the author had arrived at the conclusion that phosphate of ammonia alone or in conjunction with another substance had been finally adopted.

Mr. T. **Tyrer** wished to supplement Mr. Hooper's question by another, *viz.*, whether the woods which had been impregnated with the solution finally decided on had actually been put to any tests, and whether the impregnated woods had successfully gone through any conflagration.

Mr. O. **Guttmann** said that he was under the impression that the author was using carbonate of soda and borax. Perhaps Mr. Sayer could inform him if that was correct.

Dr. O. J. **Steinhart** asked whether the fireproofing was effected by phosphate of ammonia. That body gave rise to a fungoid growth, which might rot wood, and he would like to know the effect of saturating wood with it. He would also like to know what was the corrosive action of phosphate of ammonia on metallic parts. He considered that important, as, if phosphate of ammonia were used, iron parts might come into contact with the impregnated wood in ships, &c. He had always understood that phosphate of ammonia did affect ironwork, and that to ensure non-corrosion, galvanising was necessary.

Mr. A. **Marshall** said that it appeared to him that the author did not wish to give the real results of his experiments. Perhaps Mr. Sayer might give them some information as to the effect of some of the solutions; for instance, the ammoniacal solution of zinc oxide, if that had been tried and if so, whether it had failed.

Mr. W. F. **Reid** wished to ask whether the wood had been analysed before and after the drying process. It appeared from some of the microscopic slides that the woody substances had shrunk very considerably, and had been partially carbonised. If that were the case, ignition would not so easily be brought about. He would therefore like to know whether the author had any data as to the proportion of hydrogen in the wood before and after drying.

Mr. R. **Stewart** asked what was the percentage of phosphate of ammonia contained in the treated wood.

Dr. **Rideal** stated that the most uninflammable natural wood was heather wood, which was chiefly used for the manufacture of briarwood pipes.

Mr. **Thos. Griffiths** asked for information as to what effect the chemicals used in fireproofing wood had upon paints subsequently applied to wood so treated.

Mr. J. F. **Briggs** asked whether the crystals in the beechwood cells did not tend to burst the cells and so make the wood rather weak.

Mr. J. **Bernays** said that the natural fibre of the wood was always inflammable. If the wood were impregnated with another substance which was non-inflammable, the cells and fibres were simply filled or coated with that other substance. If the solution caused a chemical change in the wood, and gave it a different nature, he could understand that it might be non-inflammable, but when the action was simply to fill the pores, it seemed to him that the original inflammable substance remained, but was mixed with a non-inflammable substance.

Mr. J. A. **Hicks** pointed out that although the table of the strengths of woods before treatment had been supplied, they had not one showing the strengths after treatment, and he thought it would be instructive if they could have such a table before them.

Mr. H. **Sayer**, in reply, said, in answer to Dr. Rideal's remarks, they had no experience of the American wood he mentioned. As to the use of phosphate of ammonia for fireproofing, its corrosive action was referred to in the paper. Before replying to the other question he might say that they had not made claims for a fireproofing process but simply gave the results of experiments made during the working out of a fireproofing process. The process was not altogether satisfactory and might in its present state never be used, but they were still working on it and hoped so to improve it as to render it perfectly satisfactory in every respect. Their great difficulty had been to obtain insoluble salts in place of those now employed, which were all more or less soluble. When they started their experiments, they found that very little was known about the structure of wood, or at any rate it had not been taken into account in fireproofing, but it was known that the pressure required to impregnate different woods varied considerably. Teak stood a pressure under which ash collapsed, deal also stood the pressure though of lower specific gravity, and they tried to find out why by examining the structure and comparing it with the specific gravities of the various woods, and the paper showed the results obtained. They made no claims and had no formula to give. If an alkaline salt were used to fireproof timber, the wood would be rendered short, and if an acid were used the wood charred on drying. If copper salts were used they would corrode metals brought into contact with the wood so impregnated, and ammonia and soda salts were soluble. Many processes had been suggested in which a soluble fireproofing material and an insoluble stopping were used, but they all had their drawbacks. With regard to the crystals tending to burst the cells, they were aware that fireproofed wood was not, as a rule, so strong as unfireproofed, but they had not made any actual tests on the matter. If the fireproofing material were liable to wash out it was hardly worth while making a series of elaborate tests. When they had a material which would not wash out and was otherwise satisfactory they would give more attention to testing the strength of the impregnated wood. Mr. Reid had asked whether any decomposition took place during treatment of the wood. They had not made an analysis so he was hardly in a position to answer that question. They had said that one of the ideal properties of fireproofed wood was that it should take paint and be capable of taking a polish. Woods impregnated with salts of ammonia would do that, but the results were not satisfactory in other directions.

Mr. **Roberts**, interposing, asked how long the polish had been on the samples shown.

Mr. **Sayer**, continuing, said that the polish on the sample shown was applied two or three months before, but he could not say more definitely. No special processes were supported in the paper. There were dozens of fireproofing salts, such as phosphate and sulphate of ammonia, but he could not tell them which was the actual one they were going to use, although it was included in the list given in the paper, nor could he give the exact figures. He could only repeat that they were in the fireproofing materials mentioned, and that they were ammonia salts. The fibres were not changed but were simply coated. On being heated the ammonia was volatilised and extinguished the flame. In reply to another question, they had not, as he previously stated, made any experiments on the strength of the wood after fireproofing, but they knew that the strength was decreased, especially if the wood were oversteamed. Wood so oversteamed appeared discolored and was rendered brittle.

Mr. **Briggs** said that he had read that the Admiralty had tried impregnating with sodium silicate and calcium salts alternately.

Mr. **Sayer** replied that there was a process by which sodium silicate, after being injected, was precipitated by means of ammonium chloride, but they had not heard of its being used by the Admiralty; they had, however, used tungstate of soda, but had abandoned it on account of its cost and the increase in weight of the fireproof wood.

The **Chairman** said he was sure that all members present during the reading of the paper by Mr. Sayer must have felt, that while they admired the excellent micro-photographs of sections of wood, there was something wanting in the paper itself. He hoped that the author would forgive him for saying, that, whilst he had given them a list of processes, they at the end of the lecture were not much wiser than they had been before. He quite understood, that some of the processes that had been employed by Mr. Cowper-Coles were only in an experimental stage, but of the author's conclusions as to the respective merits of the different processes they had learnt practically nothing, and in this connection he would remind the author, that the members of the Society came to the meetings as to an educational institution in order to carry away something to associate with the name of an investigator of a particular subject, of an inventor of a new process. He hoped that Mr. Cowper-Coles or Mr. Sayer would some day supply the omission. That there was a need for a process of fire-proofing wood was shown by the many patents that had been taken out. While none of these processes appeared to fulfil the series of conditions laid down in the paper, he (the Chairman) thought it was somewhat unreasonable first to lay down ideal conditions with the whole of which a process should comply, without taking into consideration the use to which the fireproofed wood was intended to be put. For different conditions different kinds of fireproofing might be required. In some cases it was quite immaterial whether the salts employed were soluble in water or not, as for instance in that of the rafters of a house, which were always dry. On the other hand, for use on board ship soluble salts would be out of the question. Discoloration again made no difference where the wood was to be painted over. If the author of the paper were to look at the matter in that light they might be able to give information of a number of processes which might be useful to the Society. A question had been asked about the principles underlying fireproofing wood. Of course, every kind of organic matter was combustible, and there were no means of making organic matters really incombustible. All that could be done was to render them less liable of bursting into flame. From the list of materials the author had given them, it was evident that these materials might be put into a few classes: those which, like zinc and calcium chlorides, kept the wood moist; salts of ammonium, which produced a nitrogenous charcoal with carbonaceous matters which burnt with great difficulty; and fusible materials, which covered the organic substance and prevented the action of the atmospheric oxygen. Fusible salts were, as a rule, salts of alkalies, and these were nearly all water soluble.

THE PREPARATION OF STANDARD SOLUTIONS OF SULPHURIC ACID.

BY ARTHUR MARSHALL, A.I.C.

(This Journal, 1899, 4—6.)

Addendum.

The author offers the following formula, which embodies the three previously given, for obtaining the percentage of H_2SO_4 from the specific gravity at all ordinary temperatures:—$P = S(85\cdot87 + 0\cdot05T - 0\cdot0004t^2) - 69\cdot82$, where P = percentage of H_2SO_4 by weight in the acid, and S = sp. gr. at T° C., compared with water at t° C.

The above formula may be used between 0° and 40° C. for acids containing 62 to 82 per cent. H_2SO_4.

Erratum.

In Table I., col. 1, p. 5, for "(*b*) 0·1° C." read "(*b*) 1·0° C."

IMPROVED APPARATUS FOR THE ESTIMATION OF CARBONIC ACID IN MINERALS.

BY ARTHUR MARSHALL, A.I.C.

(This Journal, 1898, 1106.)

Erratum.

On p. 1106, col. 2, line 23 from bottom, for "top of B," read "top of E."

Manchester Section.

Meeting held on Friday, December 1st, 1899.

DR. J. GROSSMANN IN THE CHAIR.

NOTES ON THE ANALYSIS OF SOME SUGAR SYRUPS.

BY ALEX. K. MILLER, PH.D., AND J. P. POTTS.

In a paper published in the "Analyst" (1889, p. 253), Messrs. Bodmer, Leonard, and Smith describe the method they have adopted for the analysis of "golden syrup." At the outset of their paper, they state that the subject has recently called for considerable attention on the part of analysts, and from the fact that there have lately been several convictions for adulteration, the question of the analysis of these syrups is certainly of some importance. Following the lead of our Chairman in his interesting address at our last meeting, we think that a discussion of new methods which are brought forward for general adoption, would lead to a better understanding of their merits or their demerits, their limits of accuracy, and in the case of adulteration, the limits within which we are justified in pronouncing upon the percentage of added substance. In the case of "golden syrup," the question is one of adulteration with so-called glucose syrup. A qualitative examination for this purpose, *i.e.*, the mere detection of adulteration, is a comparatively simple matter, and had Messrs. Bodmer, Leonard, and Smith confined themselves to the detection of the presence of glucose syrup, we should not have thought it necessary to discuss their paper, as we do not in the least doubt their ability to settle the question in a satisfactory manner. Their method professes, however, to be essentially a quantitative one, and it is on this ground that it comes within the scope of our remarks. For convenience we may discuss separately (*a*) the methods of analysis, and (*b*) the interpretation of the results.

The chief determinations to be made in the case of a genuine golden syrup are (1) cane sugar, (2) invert sugar, (3) water, and (4) ash. A determination of the nitrogen may also be useful as affording some information as to the quality of the sugar syrup, or its degree of refinement, but has clearly no connection with the question of adulteration. The authors estimate the water in the usual way, by calculating the total solids from the density of a 10 per cent. solution, the water being then calculated by difference. But in their use of the ordinary factor 3·86, they make no allowance whatever for the well-known fact, that sugar ash has about double the solution density of the carbohydrates, and by omitting to take this into account, an error is introduced amounting probably to between 2 and over 8 per cent. in their analyses, the error being, of course, greatest where the percentage of ash is largest. The importance of allowing for the greater solution density of the mineral matter was pointed out by Heron in 1896, in a paper on the analysis of invert sugar, but it appears to have been recognised in America at least two years earlier, the same factor 8·0 as recommended by Heron being used by Weber and McPherson in 1894 (11th Annual Convention of the Association of Official Agricultural Chemists). The most important determinations, however, in the case of the syrups under discussion, are the reducing power on Fehling solution, and the rotatory action on polarised light. The authors make three determinations with Fehling solution,

(1) in a solution of the syrup of suitable strength, (2) in a similar solution after inversion of the cane sugar, and (3) in another solution which has been submitted to prolonged heating with hydrochloric acid. If the syrup is a genuine one, the first result will represent the invert sugar, and the difference between 1 and 2, the cane sugar. If the syrup is adulterated, No. 1 Fehling will be due partly to invert, and partly to the maltose and dextrose present in the added glucose. No. 3 Fehling is dependent upon a variety of chemical reactions and for quantitative purposes must be regarded as valueless. With regard to the use of the Fehling test, we will merely add that the authors do not adopt a uniform method of working, although the importance of doing so has long been recognised. Otherwise the method given for the determination of the invert and cane sugar is fairly satisfactory; but in the case of the latter sugar, equally good results may be more easily obtained by means of the polarimeter. The error, due to the assumption that invert sugar has the same reducing power as dextrose, may perhaps be passed over in the case of a comparatively crude substance such as golden syrup. The best method of analysing a genuine sugar syrup would appear to be that described by G. H. Morris, in a paper on the analysis of invert sugar and glucose, published early last year (J. Fed. Inst. Brew. 1898, 162), and although, owing to the cruder nature of many of these syrups, the results may be less accurate than in the case of the sugars dealt with in his paper, they would certainly be nearer the truth than by employing the somewhat crude method proposed by Bodmer and his colleagues. We need not enter into the details of Morris's method, as it has been fully abstracted in the Journal of this Society (1898, 496). The following are two examples of analyses which we have made by Morris's method, and there can be no doubt they represent genuine sugar syrups :—

——	1.	2.
Water	16·8	16·5
Dextrose	20·7	22·5
Levulose	23·4	20·6
Cane Sugar	33·6	30·6
Ash	2·0	1·9
Undetermined Matters	3·5	7·9

When it is a question of analysing a mixture of a sugar syrup with a glucose syrup, the matter becomes far more complicated. The chief carbohydrate constituents of such a mixture will be cane sugar, dextrose, levulose, maltose, and dextrin, and the determination of each of these is no simple matter, and is further complicated by the impurities always present in the sugar syrups. Messrs. Bodmer, Leonard and Smith make no serious attempt in this direction, but they adopt what they consider to be the convenient plan of regarding commercial glucose as an individual substance, or chemical unit. It is evident that if, on the one hand, we could regard commercial glucose as one unit having a constant rotation and a constant reducing power, and on the other hand, golden syrup as another unit with its constants, the analysis of a mixture of these two individuals would become a simple matter. The constants adopted for glucose syrup are taken from a paper published by Boseley (Analyst 1898, 125) and are K = 53 and $[\alpha]_D$ = 134. These factors represent the mean of 10 analyses, and the question at once arises, are we justified in using the average of a few analyses as constants? The answer to this must depend (*a*) upon whether the samples analysed may be regarded as being fairly representative of the composition of commercial glucose, and (*b*) upon the extent to which the different samples differ in composition, as if the differences are very wide, the use of an average as a constant cannot be justified. Nine out of the ten analyses mentioned are from Weber and McPherson's paper (*loc. cit.*) and they show very great differences in composition; the extremes as regards copper reducing power and specific rotation, are as follows:—(1) K = 43 and $[\alpha]_D$ = 149, (2) K = 61 and $[\alpha]_D$ = 120·6, and in order to ascertain the extent of the error introduced by averaging these results, we have re-calculated some of Bodmer's analyses using both of these sets of figures. In the following table the upper figures are taken from their paper; the second set of figures represent the two extremes calculated as above, and the last set of figures show the percentage of glucose syrup as estimated by them.

——		5.	3.	2.	15.	24.	4.
Invert Sugar		17·3	14·4	7·2	..	..	..
Glucose		39·4	47·1	61·0	67·9	71·8	75·0
Invert	highest	22·8	20·9	15·4	8·9	5·7	3·6
	lowest	12·4	8·2	− 1·0	− 9·4	−13·4	−16·3
Glucose	lowest	35·9	43·1	56·0	62·3	65·8	68·8
	highest	42·4	51·2	66·4	74·0	77·7	81·2
Cane sugar syrup		55·0	40·0	25·0	20·0	15·0	10·0
Glucose syrup		45·0	60·0	75·0	80·0	85·0	90·0

It will be seen that the differences vary in the different analyses and may lead to a considerable error, which, however, is less in the case of the glucose than in the invert; in the latter, the greatest difference amounts to about 20 per cent., and in the former to about 12 per cent., and we may roughly estimate the probable error at, say, half these figures. This, however, is not all. The percentages of "glucose" so far represent anhydrated glucose, and in estimating the glucose syrup, the authors further complicate the matter by bringing the amount of cane sugar into the calculations. This means an adjustment of percentages as shown in the two last lines of above table and adds to the error just mentioned. A closer examination of the authors' figures shows in a more striking manner yet the extent to which they have been misled by the use of averages as constants. They state that some samples of sugar syrup are simply glucose sweetened with cane sugar, and they give three analyses, Nos. 15, 24, and 4, representing such sugars. We find, however, that in the case of Nos. 24 and 4, they have not completed their calculations, and had they done so, they would have found a *minus* quantity of invert in both these sugars. It is difficult to understand how the authors could fail to notice this fact, which alone is sufficient to condemn the analysis; and on following it up we find that, by the use of the authors' own figures, equations and constants, it is possible to arrive at results differing by 15 per cent. in the case of No. 4 and to a smaller extent in No. 24; and this error being purely incidental to the calculations, should not exist at all. This result is arrived at as follows:—

By taking the two following equations given by the authors namely, $K = i + 0·53\,x$, and $[\alpha]_D = \frac{66·5\,s + 134\,x - 23·1\,i}{100}$ we find in analysis No. 4, that x (*i.e.*, glucose) = 75 as stated by them, but that i (invert) = − 6·6, this fact being ignored by them, apparently on the assumption that a minus quantity means nothing. As a matter of fact, however, the 75 per cent. of glucose is dependent upon the presence of this minus quantity of invert, and if we ignore the one, we must ignore

——	1.	2.	3.	4.	5.	6.	7.	8.	9.
*Rotation of 10 per cent. solution	18·0	16·4	8·1	7·6	54·6	52·1	52·2	48·5	31·9
,, after inverting cane sugar	5·2	− 4·0	− 7·3	− 9·4	48·2	48·2	47·4	41·8	14·6
Cane sugar per cent.	46·2	40·6	30·6	33·8	12·7	7·7	9·5	13·3	34·4
Rotation due to cane sugar	17·7	15·6	11·7	13·0	4·9	2·9	3·6	5·1	13·2
Original rotation less that due to cane sugar	0·3	0·8	− 3·6	− 5·4	49·7	49·2	48·6	43·4	18·7
Rotation after fermentation	0·6	0·6	0·4	0·8	30·4	29·8	25·4	25·8	12·0
$[\alpha]_D$ of syrup	31·1	28·4	14·0	13·1	94·4	90·1	90·3	83·9	55·2

* Taken in 200 mm. tube, in Schmidt and Haensch half-shadow instrument.

the other, and the result is an impossibility. This is at once clear if we take the equation $K = i + 0{\cdot}53\,x$, which means that the reducing power of the sugar is due partly to invert and partly to glucose if both substances are present. If, however, there is no invert present, i must equal o, and the equation becomes $K = 0{\cdot}53\,x$, and x (glucose) then becomes 62·6. This figure, which thus takes the place of the authors' 75·0. is really the *maximum* percentage of glucose on the basis of their 53 factor, for if i be not equal to o, invert must be present; the dextrose will then be less than 62·6 and the discrepancy will be greater still. Assuming then that this figure is correct, sample No. 4 will appear to be adulterated to about the same extent as No. 2, which, however, is estimated by the authors to contain 15 per cent. less glucose, and we have thus two interpretations leading to widely different results. Under these circumstances, it is practically impossible to estimate the total probable errors, partly experimental, but largely due to the erroneous assumptions upon which the calculations are based, but we think we have shown them to be so large as to condemn the method and to prove that it cannot be regarded as yielding anything like even the approximate results which the authors claim for it.

It would appear, in fact, that any method based upon the averaging of glucose analyses must be regarded with suspicion if not condemned outright, and it seemed to us that the only way, which would be likely to lead to a satisfactory result, would be to determine the constituent carbohydrates forming the glucose, that is the maltose, dextrose, and dextrin, but so far we have not met with success. The estimation of these carbo-hydrates in a glucose syrup presents no difficulties, but when mixed with invert and cane sugars, the matter becomes complicated, and the results are rendered still more uncertain by the impurities always present in sugar syrups.

We are therefore of opinion that there is as yet no satisfactory quantitative method of analysing sugar syrups adulterated wtth glucose, and that until such a method has been devised, analysts must be content with a qualitative test. The polarimeter undoubtedly affords the best and the simplest means for providing such a test. In many cases a single reading in the polarimeter will at once show the presence of "glucose," but it is generally advisable to go further than this, and we have found the following method useful:—Determine reading of a 10 per cent. solution (or other suitable strength) of the syrup; invert the cane sugar in a portion of solution, and again determine rotation. From the difference between the two readings, we can determine the cane sugar, and from this we calculate the rotation due to the cane sugar. If we deduct this from the original rotation, the difference will represent the rotation due to the dextrose and levulose if the sugar is a genuine sugar syrup, and the result will generally be a levo-rotation. It appears, however, that the dextrose and levulose are not always equal in amount, but are liable to vary within narrow limits, and on this account we should attach no suspicion in the case of a sample, which, calculated as above, showed no levo-rotation or showed even a very low dextro-rotation of, say, a fraction of a degree, as in Nos. 1 and 2. On the other hand, if glucose is present, a marked dextro-rotation will be left after deducting that due to cane sugar, and the degree of rotation will afford also some guide as to whether glucose has been added in large or small amount.

Should there be any doubt, however, the sugar may be fermented, and the rotation again determined. As dextrin is always present in glucose syrups, and as it possesses a very high rotation, the rotation of the fermented solution affords a good confirmatory test. We give below some analyses carried out as described, and a glance at the figures will show that Nos. 1, 2, 3, and 4, may be regarded as pure, whilst the other samples undoubtedly contain glucose syrup, the percentage of which is evidently high in Nos. 5, 6, 7, and 8, but less in 9. It will be noticed that in each of the four unadulterated samples, there is a small dextro-rotation after fermentation, and this is apparently to be attributed to optically active unfermentable bodies in the sugar syrups.

It is of course possible that others have adopted some such method as this, and perhaps an improvement upon it, but there appears to be no recognised method of analysis, and it is on this account that we believe a discussion on the subject should prove useful.

In conclusion, we would add that we have used the term adulteration merely in the sense that a syrup containing "glucose," if sold under the name of "golden syrup" or "treacle" is considered to be adulterated under the Sale of Food and Drugs Act. Such a mixture may of course be sold under any other name the manufacturer likes to give it, and from the consumer's point of view, we should not like to say that the mixture is less wholesome than genuine golden syrup. Most of the glucose preparations are very pure products, and they certainly have the advantage of being free from the impurities always present in cane and especially in beet syrups.

Newcastle Section.

Meeting held in the Chemical Theatre of the Durham College of Science, Thursday, December 14th, 1899.

MR. N. H. MARTIN IN THE CHAIR.

PROTECTIVE PAINTS FOR IRON.

BY HARRY SMITH, F.I.C.

On February 2nd, 1894, Mr. W. Thomson read a paper before the Manchester Section on the Oxidation and Corrosion of Iron and Steel, in which he refers to certain experiments in which I had the pleasure of assisting him (see this Journal, 1894, 118).

The Journal for March 1885, 227, alludes to experiments on this subject made by the Dutch Railway Company and the Cincinnati Southern Railway Company.

The "Engineering and Mining Journal" (1890, 50, 648) recommends that iron surfaces should be washed and brushed with hot linseed oil, and states that small objects may be heated until the linseed-oil coating begins to fume, and that paint adheres well to iron surfaces which have been treated in this way.

In the "Engineer" for January 30th, 1891, is an article on Painting Ironwork, the writer of which insists upon this preliminary treatment with hot oil. He also says: "Iron that has been vitriolled ought to be well washed and carefully dried before the paint is applied."

I would also refer you to the article on the Permeability of Paints to Water and Gases, by J. Treumann (this Journal, 1898, 1056).

"Engineering" for September 20th, 1895, in Notes on Painting Ironwork, refers to a communication made to the American Society of Civil Engineers by E. Gerber, who finds that iron-oxide paints adhere better to ironwork than lead paints. Asphaltum paints are not satisfactory.

A. H. Sabin, formerly Professor of Chemistry in the University of Vermont, states: "Iron oxide paints should not be used on iron, as the pigments themselves act as carriers of oxygen to the underlying iron and produce rusting. Also, linseed oil makes a porous coating through which moisture can pass.'

The "Engineer" of October 22nd, 1897, has an article on the Protection of Iron by Paint. The writer of this article concludes as follows:—

"The surface of the metal should be cleaned from rust and scale; the paint should not dry more quickly than is necessary having regard to the exigencies of the work in hand, and attempts should not be made, by the promiscuous introduction of extra driers, to hasten it in this particular; care should be taken that the dried film is sufficiently elastic to avoid danger of mechanical injury or of cracking when the iron expands by heat; at least three, or, better still, four coats should be put on the metal in order that the covering may be as thick and non-porous as possible. Only those pigments should be employed which possess good covering power, which yield a paint adhering strongly to the metal, and which, having the lowest specific gravity consistent with these requirements and with a sufficiently low price, will carry the largest proportion of vehicle, and will accordingly allow the maximum of oil or varnish to be applied to each portion of the surface of the iron."

Early in the year 1898, Max Toltze read a paper before the Civil Engineers Society of St. Paul, Minnesota.

He recommends the following treatment for iron :—

"1. Give the iron and steel a coat of the best grade of refined linseed oil, properly boiled and settled clear, or, still better, mix linseed oil with about 10 per cent. of a good grade of lampblack; this coat to be applied at the mills, the iron or steel being first carefully cleared from loose scales."

"2. After the structures have been erected, give them one coat of real asphaltic varnish paint, made from the best grade of asphalte, linseed oil, and gum, compounded properly, so as to form a true varnish; or a paint made from carbon black, and a properly boiled varnish, composed of the best grade of linseed oil and gum. . . . . As a second coat, a good coat of graphite paint is applied as thickly as possible. . . . . No turpentine, no benzine, and no japan or driers should under any circumstances be allowed in this paint."

Toltze examined a number of paints, which he classifies as follows :—

"1. True asphaltic varnish paints.

"2. So-called asphaltic varnishes or paints, of inferior quality.

"3. Black carbon paints in which the vehicle is practically a varnish.

"4. Iron-oxide paints.

"5. Graphite paints and silica-graphite paints. . . . . The paints were subjected to a systematic practical test to ascertain their real value as anti-rust paints. For that purpose comparative tests, by painting pieces of sheet iron, tinned iron, and galvanised iron, wooden boards, and shallow sheet-iron, dishes were carried on.

"The iron dishes were about 12 inches in diameter and about half an inch deep, having a capacity of about half a pint. The scale or skin was carefully removed before painting, so as to have a clean surface of iron exposed to the paint. Two dishes were painted with each kind of paint, one of them receiving one coat, the other two coats, the first coat having dried thoroughly (for at least a week) before the second coat was applied. After the second coat had completely dried and hardened, these dishes were exposed to the so-called water-and-moisture test, in which a given amount of water is placed in the dishes and allowed to evaporate to dryness at the ordinary temperature of the room. This is repeated a number of times until the inside of the dishes begins to show more or less rust. All dishes were carefully examined before each refilling. After most of the water has evaporated, there remains at the junction round the edge a thin film of water, which, in contact with the carbonic and other acids in the air, acts on the paint in such a way that the iron under the paint begins to rust. The rust thus formed develops more and more after each evaporation, in some cases practically covering the whole dish in a short period."

Toltze obtained the best results in this test with the genuine asphalte varnishes and with graphite paints; he does not appear to have examined red-lead paints in this way, but found a very considerable amount of rust was produced in the dishes covered with iron-oxide paints.

The "Engineer" of December 23rd, 1898, refers to tests made by Baucke with the various oxide of iron pigments which are manufactured for use in paint. He decides that a red oxide is the best to employ after making allowance for the increasing cost of manufacture. In the same paper we have a reference to tests carried out in America by G. R. Henderson, who finds that tinned and galvanised iron each lasted best when painted with a first coat of white lead and a second coat of zinc white. Sheet iron appeared to prefer a mixture of two-thirds white lead and one-third zinc white . . . . but lead for the priming (or first) coat was indicated.

In an article on Painting Locomotive Engines ("Engineer," October 6, 1899) the writer says :—

"The only true rust preventatives are the leads in the white and red condition, and the paint which comes the nearest to effectual prevention of rust should be composed of two of white lead and one of red lead . . . . Black possesses no power to prevent formation of rust . . . . The red paint known as oxide of iron, and which was claimed to be a rust preventative, possesses no inherent quality of that kind, and whatever is due in that respect is solely attributable to the oil with which it is mixed."

I should like to say here that my thanks are due to the editors of "Engineering" and the "Engineer" for permission to make use of the extracts quoted in this paper.

During the last two years I have carried out a series of tests, which are an extension of those made by Mr. Thomson and myself in 1894.

I thought it desirable to examine and compare the paint pigments which are in everyday use as paint materials in this country, and especially to determine the effect produced by the introduction of inert pigments such as barytes (natural barium sulphate), and Paris white (whiting or calcium carbonate) which are employed as diluents, and to satisfy the demand for a cheap class of paints, and not with any idea of adulteration.

The tests were carried out in three different ways :—

1. By painting shallow iron dishes and exposing them to the action of slowly evaporating water, as described in Mr. Toltze's experiments quoted above;

2. By exposing a set of painted iron plates to the action of the weather for a period of 12 months; and

3. By exposing painted iron plates to the continuous action of water in a similar manner to the tests made by Mr. Thomson and myself in 1894.

The paints employed were prepared by grinding the pigments with linseed oil on granite rollers to a stiff paste in the proportions given below; these were thinned to the consistency of ordinary paint with boiled linseed oil of the best quality, and capable itself of yielding a dry film on a glass plate in about seven hours under ordinary conditions of temperature, &c.

Each plate or dish was given two coats of paint, the second being applied after the first had become thoroughly dry; the tests were commenced when the second coats all appeared to be dry and firm.

Let us take the dishes first. Each dish was about 5 inches wide by half an inch deep, and was filled with ordinary town's water; they were placed side by side upon a table, and were not touched during the three months over which the trial extended; but as soon as the water had completely evaporated from each dish it was immediately refilled with fresh water. During the three months each dish dried and was refilled six times; and they are on the table before me, if you care to examine them.

In most cases all traces of paint have disappeared, and there is present a thick deposit of rust mixed with the suspended and soluble impurities present in the evaporated water.

The dishes painted with the following paints are practically unaffected, and have withstood the very severe conditions of the trial :—

Red-lead paint	Practically unaffected.
"A" red-lead paint	
"B" red-lead "	
Orange lead "	
Vermilionette "	
Scarlet-red "	

The following are somewhat rust-stained, and are placed in order of merit :—

Zinc-white (oxide) paint	Slightly rust-stained, placed in order of merit.
"A" zinc-white "	
"C" zinc-white "	
Lithopone "	
White-lead "	
"A" white-lead "	
"C" white-lead "	

As to the 36 other paints tried in this way, all appear to have suffered equally; but it was noticed that the dish painted with boiled linseed oil simply was the first to show deterioration, and has apparently produced the greatest amount of rust.

2. The 49 iron plates which were painted and exposed to weather for 12 months all withstood this test remarkably well, showing that all the paints were of fairly good quality under moderate conditions. There was one exception, however: the plate which received two coats of boiled oil speedily became spotted with rust, and at the end of the year was much corroded. All the painted plates became very much darker in colour, owing to the deposit of soot from the air, but most of this I have since removed by rinsing the plates under the water tap.

3. In these experiments I painted strips of sheet iron as before; and when the second coats were all dry and hard each plate was placed in a wide-mouthed glass bottle, and the same volume of ordinary tap water was added in each case. The bottles were then placed on a shelf immediately below the laboratory bench, so that the open mouths of the bottles were about one-eighth of an inch from the under side of the table; in this way the entrance of dust was almost entirely prevented and evaporation was greatly checked, but there was access of air to the interior of each bottle.

In this third series the tests were made in duplicate for the sake of greater accuracy; the figures given below in the third column are the mean of two results, and the duplicates agreed very closely with each other in almost all cases.

The bottles were now allowed to remain untouched for three months. After about seven days several of the plates were perceptibly affected; this was shown by a turbidity in the water; as oxidation proceeded a red precipitate of ferric oxide or rust appeared and slowly subsided to the bottoms of the bottles. After three months' exposure the plates were removed, and the amount of iron present in the liquid and the deposit of rust in each bottle were determined by analysis, and the total amounts of ferric oxide obtained in each case were calculated to pounds weight of rust per 1,500 sq. ft. of painted iron surface; but, of course, this is rather under than over the total amount of corrosion, as a certain quantity of corroded iron was loosely attached to each plate and to the film of paint. The results obtained and the composition of the paint in each case are shown in the following table, and it must be understood that these paints are the same as those employed (1) on the shallow iron dishes, and (2) on the plates which were exposed to the weather for 12 months:—

Paint.	Composition.	Rust from 1,500 sq. yds.
	Per Cent.	Lb.
Red lead:—		
Red lead	88·88	None
Raw linseed oil	11·12	
"A" red lead:—		
Red lead	45·00	None
Barytes	45·00	
Raw linseed oil	10·00	
"B" red lead:		
Red lead	22·00	None
Barytes	66·00	
Raw linseed oil	12·00	
Orange lead:—		
Orange lead	88·88	None
Raw linseed oil	11·12	
**Vermilionette:—*		
Barytes	33·33	None
Vermilionette	58·80	
Raw linseed oil	7·87	
†Scarlet red:—		
Scarlet red	88·88	None
Raw linseed oil	11·12	
Pure zinc white:—		
Zinc white (zinc oxide)	87·30	Traces
Refined linseed oil	12·70	
"A" zinc white:—		
Zinc white	45·00	Traces
Barytes	45·00	
Refined linseed oil	10·00	
"C" zinc white:—		
Zinc white	27·27	Traces
Barytes	63·63	
Refined linseed oil	9·10	
White lead:—		
White lead	92·56	75
Refined linseed oil	7·44	
"A" white lead:—		
White lead	53·78	80
Barytes	40·33	
Refined linseed oil	5·80	
Pale oxide:—		
Pale oxide (about 52 % Fe_2O_3)	83·60	81
Boiled linseed oil	16·40	
Lithopone:—		
Lithopone (zinc sulphide, zinc oxide, barium sulphate).	87·50	90
Refined linseed oil	12·50	
"C" White lead:—		
White lead	50·52	95
Barytes	42·10	
Refined linseed oil	7·38	
"A" Red:—		
Barytes and calcium carbonate	78·80	118
Ferric oxide (95 % Fe_2O_3)	8·47	
Raw linseed oil	12·73	
"C" red:—		
Barytes	80·57	123
Ferric oxide (95 % Fe_2O_3)	7·55	
Raw linseed oil	11·88	
Deep oxide:—		
Ferric oxide (96 % Fe_2O_3)	86·89	123
Raw linseed oil	13·11	
Middle oxide:—		
Ferric oxide (94 % Fe_2O_3)	86·89	134
Raw linseed oil	13·11	
Extra bright oxide:—		
Ferric oxide (90 % Fe_2O_3)	82·35	137
Boiled linseed oil	17·65	
Barytes:—		
Barytes (natural barium sulphate)	88·00	155
Raw linseed oil	12·00	
Pure oxide "C":—		
Ferric oxide (90 % Fe_2O_3)	76·30	160
Boiled linseed oil	23·70	
"C" celestial blue:—		
Barytes and calcium carbonate	78·04	160
Celestial blue (a form of Prussian blue).	9·74	
Raw linseed oil	12·22	
"B" Prussian blue:—		
Prussian blue	22·76	168
Barytes	45·52	
Raw linseed oil	31·72	
Pure middle chrome yellow:—		
Middle chrome yellow	83·58	177
Raw linseed oil	16·42	
Pure raw sienna:—		
Raw sienna	74·66	197
Raw linseed oil	25·34	
Pure graphite:—		
Graphite	69·56	215
Raw linseed oil	30·44	
Pure Prussian blue:—		
Prussian blue	48·27	221
Raw linseed oil	51·73	
Pure Indian red:—		
Indian red (70 % Fe_2O_3)	82·35	227
Raw linseed oil	17·65	
"A" Vandyke brown:—		
Vandyke brown	56·00	230
Barytes	13·33	
Raw linseed oil	30·67	
"B" middle oxide:—		
Barytes	76·22	244
Oxide of iron	12·30	
Raw linseed oil	11·48	
Ivory black:—		
Drop black (charcoal black)	60·00	250
Boiled oil	40·00	
Turkey red:—		
Turkey red (95 % Fe_2O_3)	81·16	262
Raw linseed oil	18·84	
"A" celestial blue:—		
Barytes and calcium carbonate	80·56	266
Celestial blue	11·83	
Raw linseed oil	7·61	
"B" Chinese blue:—		
Chinese blue (another form of Prussian blue).	22·76	275
Barytes	45·52	
Raw linseed oil	31·72	
"A" Italian ochre paint:—		
Italian ochre	38·74	296
Barytes	19·00	
Raw linseed oil	42·26	
**"A" Middle Brunswick green:—*		
Barytes and calcium carbonate	69·99	309
Superior middle Brunswick green	18·24	
Raw linseed oil	11·77	
"C" Middle green:—		
Barytes	78·32	322
Superior Brunswick green	9·79	
Raw linseed oil	11·89	

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* "Vermilionette" is a pigment composed of orange lead on which has been precipitated about 10 per cent. of eosine.

† "Scarlet red" is red lead on which has been precipitated aniline scarlet.

* As mixture of lead chromate and Prussian blue.

Paint.	Composition.	Rust from 1,500 sq. yds.
	Per Cent.	Lb.
[illegible] yellow :—		
Barytes and calcium carbonate......	63·07	323
Chromate of lead..........................	22·51	
Umber	3·31	
Raw linseed oil..............................	11·11	
English umber :—		
English umber	57·51	336
Raw linseed oil	42·49	
"*A*" *Black* :—		
Barytes and calcium carbonate	68·99	352
Carbon black	8·42	
Manganese dioxide	2·46	
Boiled linseed oil	20·13	
Burnt Turkey umber :—		
Burnt Turkey umber	59·20	353
Raw linseed oil..............................	40·80	
"*C*" *yellow* :—		
Barytes and calcium carbonate	79·28	369
Chromate of lead	8·31	
Raw umber	1·72	
Raw linseed oil..............................	10·69	
"*C*" *black* :—		
Barytes and calcium carbonate......	79·30	392
Carbon black	4·35	
Manganese dioxide	1·30	
Raw linseed oil..............................	15·05	
Middle purple brown :—		
Barytes and calcium carbonate	62·52	398
Oxide of iron..................................	27·03	
Raw linseed oil..............................	10·45	
"*A*" *ultramarine* :—		
Ultramarine....................................	52·63	425
Barytes..	26·32	
Raw linseed oil..............................	21·05	
Burnt sienna :—		
Burnt sienna..................................	56·00	439
Raw linseed oil..............................	64·00	
Chinese blue :—		
Chinese blue	48·27	442
Raw linseed oil..............................	51·73	
Boiled linseed oil :—		
Boiled linseed oil..........................	..	500
Raw Turkey umber :—		
Raw Turkey umber..........................	51·85	510
Raw linseed oil..............................	48·15	

I think that these three series of experiments, carried out under such widely different conditions and yet yielding such similar results, go to show that red or orange lead form the best basis for paint pigments amongst those which are in every day use for ironwork, especially in situations where excessive moisture is likely to be met with.

At the same time it must be said that, owing to the vigorous chemical action set up in such paints, it is necessary that the mixing process shall immediately precede the actual painting. The red lead and oil must also be properly incorporated by grinding, to obtain the most satisfactory paint, and this introduces at once a serious practical difficulty. It is not sufficient to purchase the red lead and oil separately and mix them by stirring, though I am aware that this is sometimes done; but such a course, I believe, cannot yield a very excellent result.

Red-lead paints have not quite the same degree of firmness as a good oxide of iron paint, which will withstand a great amount of rough usage when once it is perfectly dry; and this tough and elastic coating yielded by genuine oxide of iron paints has much to do with their undoubted popularity for outdoor work; the colour also is far more pleasing to the eye than the crude, harsh tone possessed by red-lead paints.

Zinc oxide appears to have a very high protective value as a pigment for use on iron, and stands better in this respect than white lead; also, zinc-white paint, when pure, has a good body and covering power, and has the great advantage of being non-poisonous to the workers.

In a somewhat similar, but less severe, series of trials made in 1897 I got a better result with graphite paint than in these experiments. A pure graphite paint was used, and the result showed more corrosion than with pure zinc-oxide paint, but less corrosion than with pure oxide of iron paint; red-lead paints in these experiments also gave the best results, and still show no rust after two years' immersion. Graphite paint, however, has much to recommend it—good covering power and non-poisonous character; it has been highly spoken of in a paper written by Professor Spennrath, Director of the Technical School of Aix-la-Chapelle.

It is interesting to note the effect produced by the inert pigments, barytes and Paris white.

A paint made with barytes and oil alone (which, of course, is only introduced as an experiment, and is not suitable for actual work) stands remarkably high in the list, and is, in fact, about midway between the best and worst of the paints in protective value, and it shows that barytes is something more than a mere adulterant, as many people have supposed. A pigment of high protective power, such as zinc oxide, is shown by my experiments to be somewhat depreciated by the introduction of barytes; but, on the other hand, pigments such as Chinese blue are to be immensely improved by its presence. I believe the best treatment for iron structures is to give them one or two coats of genuine red-lead paint, freshly ground; and I would follow this up with at least two coats of either a genuine oxide of iron paint, or, in some cases, of zinc-white paint made from pure zinc oxide and genuine linseed oil.

Mr. W. Westhofen, in an article which appeared in "Engineering" on February 28th, 1890, and describes the building of the Forth Bridge, speaks of the painting of the structure as follows:—"All plates, bars, angles, and other parts belonging to the superstructure received, as soon as they had passed through the shops or yards, a thorough scraping with steel scrapers and steel-wire brushes, and afterwards a coat of boiled linseed oil was applied as hot as possible. As soon after erection upon the structure as could conveniently be done, and in many cases also before they were put up, they received a coat of red-lead paint, and subsequently a second coat of red lead. The paint finally decided upon for the bridge is an oxide of iron paint, of which two coats are applied over the two coats of red lead already laid. The first is called a priming coat, of dark chocolate-brown; the last is a finishing coat of a bright Indian or Persian red, which, however, darkens considerably in a short time."

This treatment is so very similar to that which I recommend, I thought it worth while to make some enquiries as to how the paint on the Forth Bridge has withstood the action of the weather; and I have recently received from Mr. A. Hunter, the resident engineer, a very complete report on this point, and I wish to thank him here for the trouble he has taken and his kindness in furnishing me with the following information.

Mr. Hunter finds the life of the paint on the upper portions exposed to the weather to be about three years, and this opinion is confirmed by what he has observed on other bridges, which latter are often allowed to go without repainting from four to eight years and in some cases even more than this; the consequence being that the iron gets deeply pitted and covered with scales of rust which can never afterwards be properly removed.

The paint inside the tubes of the Forth Bridge is as perfect as when it was first applied, more than 12 years ago.

The system which is adopted where any signs of rust present themselves is to thoroughly scale, scrub with wire brushes, and coat with boiled linseed oil, after which a coat of mixed red lead paint and iron-oxide paint is applied, followed by a finishing coat of brown oxide of iron paint. (The addition of the oxide of iron to the red-lead paint is to lighten the paint and also to bring the colour nearer to that of the finishing coat of iron oxide.)

The mixture of paint is as follows:—24 lbs., or 1 gall., of red-lead paint; and 14 lbs., or 1 gall., of iron-oxide paint. 1 lb. of this mixture covers, on an average, six square yards of surface.

The parts of the bridge which suffer the most are the lower parts near the water; the under side of the girder booms gets sprayed with salt water, and as these parts are not washed by rain they naturally are the most affected; the rusting commences on the rivet heads and the edges of the plates, and finally the whole plate is affected, and the rust develops in fungus-like patches, so that it is necessary to clean and repaint these portions once every year

r. Hunter has made a number of experiments on these rtions of the bridge with red-lead paint preceded by oil, hite lead and oil, paraffin wax, iron oxide, various anti-rrosive paints, tar and pitch, but finds that in each case e protection was not more permanent than the usual eatment, which is quite what I should expect from my wn experiments and observation, and I am glad to have it onfirmed in such a practical manner.

The only point on which we might disagree is the reliminary use of boiled linseed oil, without pigment, for a rst coat. I was hardly prepared to find in my own xperiments how very slight is the protection afforded a film of this kind; but I am still working on this oint, and hope to obtain further results from trials which e now proceeding.

New York Section.

Meeting held on Monday, November 24th, 1899.

MR. T. J. PARKER IN THE CHAIR.

DETERMINATION OF TITANIC ACID IN IRON ORE.

BY JAS. BRAKES.

DISSOLVE 1 grm. of ore in HCl, dilute with a little water, nd filter, allowing filtrate to run into an 800 c.c. beaker. fuse the residue with sodium and potassium carbonate, issolve contents of crucible in dilute HCl, and filter into ain solution. I then neutralise combined filtrates with NH_4HO until slight precipitate appears, dissolve precipitate ith a few drops of HCl, then add slowly to the solution 0 to 50 c.c. of H_2SO_3, stirring constantly, and set aside in arm place until the solution is colourless.

When the solution is colourless, I boil it 30 minutes, olume being kept constant with sulphurous acid, filter hot nd wash thoroughly with hot water, ignite filter and con-ents in platinum crucible, cool, add one or two drops of ater and the same amount of H_2SO_4, and then a few c.c. f H F and evaporate carefully to dryness, ignite, cool, and eigh as TiO_2. Results from an iron ore by the above ethod gave respectively 1·00, 0·950, 0·940 per cent. itanic acid.

This precipitate of titanic acid, when the analysis is onducted properly, contains no iron; but should a small mount of iron be precipitated with the TiO_2, this can be issolved in the crucible with HCl, after final ignition and eighing, and the iron determined by any method for the stimation of minute quantities of iron.

After neutralizing the solution (before boiling) with NH_4HO and adding H_2SO_3 the volume should not exceed 250 to 300 c.c., and in filtering the precipitated TiO_2 the first filtrate should be returned through the same filter. The refiltered solution will then contain none of the pre-ipitate.

No precipitated TiO_2 adheres to the bottom of the beaker, save what a rubber-tipped rod will readily remove. Salts of aluminium remain in solution.

The above method for the gravimetric determination of TiO_2 can be made in five hours or less, which is a great saving of time. While admiring the series of experiments carried out by Dr. Gooch on the separation of titanium, his method is very long and exceedingly troublesome, especially where the chemist has a number of samples under operation at the same time.

Scottish Section.

Meeting held at Edinburgh on Wednesday, October 11th, 1899.

MR. G. T. BEILBY IN THE CHAIR.

THE NATURE AND COMPOSITION OF WASTE MATERIALS FROM PAPER MILLS.

BY R. C. MENZIES AND J. EDINGTON AITKEN.

WASTE materials from paper mills naturally divide themselves into three classes:—

(1.) Chemicals in solution such as soda and bleach.

(2.) Materials which the paper maker would rather retain in his paper, such as fibre, China clay, and resin size.

(3.) Materials which result from the working of subsidiary processes, such as lime mud produced in causticising recovered soda, and the waste lime left after extracting bleaching powder with water to make bleach solution.

(1.) In regard to the first class much has been accomplished. When esparto first came into use as a raw material an enormous waste of soda took place, as the frothy alkaline solution resulting from its treatment with caustic soda was ran into the water-courses and made them hideous. But the researches of Mr. Robert Irvine revealed that this solution could be economically treated by evaporation and subsequent incineration of the resulting mass; and this process of evaporation, in conjunction with improved and methodical washing of the raw material after boiling, has been carried to such perfection, that in well-conducted mills from 75 to 80 per cent. of the soda used is recovered.

The method employed for recovering the soda is as follows:—Caustic soda, when boiled with the raw material of paper, combines with and removes the nitrogenous and resinous compounds, leaving the cellulose in a condition readily amenable to the further processes of breaking and bleaching. The dark liquor, known as "black lye," which is run off from the boiler, contains caustic soda in excess as well as soda in combination with organic matter.

It is not our present intention to discuss the various types of evaporators and incinerators. It is sufficient to say that after the lye has been evaporated the residue is subjected to ignition, whereby the organic matter is burned off and the "soda" is obtained in the form of sodium carbonate with a variable percentage of organic matter, the further treatment of which will be considered under the third heading of this paper.

(2.) In regard to the waste of materials in the form of fibre, China clay, &c., in suspension, much remains to be done; for this waste is not only a loss to the papermaker but the cause of pollution; and in all directions the action of sanitary authorities is directed towards coercing the papermaker into keeping these substances out of the rivers.

This waste is due to the very finely reduced and weak nature of the fibres which the papermaker has now to use; the fibre from esparto or wood, as the case may be, being by no means equal to the rag fibres in use 40 years ago.

Paper, as is well known, is made by allowing the fine fibres mixed with China clay, resin size, and other necessary materials suspended in water to flow on to a wire cloth in motion, through which the water passes, leaving the fibres which go to form the sheet of paper on the top.

Unfortunately, however, and greatly owing to the extreme speed at which everything is driven nowadays, a considerable proportion of the fine fibres, &c., passes through the meshes of this wire-cloth, and is lost.

In the Esk Valley the landed proprietors obtained an injunction against certain mills, which are now trying to keep these waste products out of the water-courses; but when they have collected and dried the residue they have the greatest difficulty in getting rid of it, and in many cases it remains an unsightly accumulation, reminding one of the heaps of lime waste in the alkali country.

The quantity of this product is considerable, one mill, making about 5,000 tons of paper per annum, producing about 250 tons of this dry waste. It may therefore be estimated that about 5 per cent. of the fibre, &c., which the paper maker desires to make into paper, is lost during the process; and it is with the object of trying to discover a profitable method of disposing of this paper-making sludge that we make these observations regarding its nature and general composition.

It is estimated that several thousand tons of sludge calculated dry is annually lost from the paper-mills in Scotland.

Explanation of Table.—The first two are samples taken from a mill where the sludge is separated from the "back water;" No. 2, marked "General," consists of the material separated from all the washing waters of the mill other than No. 1. The other samples are taken directly from the machine while a paper of the size and weight mentioned was being made.

Composition of Sludge.

Source.	Clay.	Fibre.	Rosin.
	Per Cent.	Per Cent.	Per Cent.
3 machines	31·145	59·505	9·35
General	32·62	59·98	7·4
Demy. 28 lbs.	36·9	60·6	2·5
" 53 "	24·93	72·48	2·59
" 26 "	41·3	55·5	3·2
" 24 "	38·5	58·52	2·98
" 20 " (*a*)	24·0	69·34	6·66
" 20 " (*b*)	14·6	77·90	7·5
" 20 " (*c*)	13·5	78·72	7·78
" 17 "	13·5	83·84	2·66

(3.) The recovered sodium carbonate referred to under the first heading of this paper is now dissolved in water and causticised with lime. A certain proportion of caustic soda is thus recovered, but it leaves a lime mud for which the paper-maker can find neither a use nor a market.

The composition of this lime mud is variable, depending on the amount of impurities present in the recovered soda and the method of dissolving it, as also upon the amount of washing which it receives after leaving the causticiser.

If the mass is methodically lixiviated in vats and washed with successive charges of hot water it yields a clear concentrated solution of caustic soda, and the waste lime is practically free from carbonaceous matter; but if it be dissolved directly in the causticiser it is sure to contain much carbonaceous matter. The lime mud is liable to contain caustic soda, due to inefficient washing and filtering, and also any excess of lime which may have been used.

If a pure lime has been used in proper proportions, for every 100 parts of caustic lime used about 180 parts of absolutely dry lime mud will be produced. In other words, in a mill using 14 tons of lime shell per week, about 25 tons of dry lime mud is formed as a by-product. The annual amount of "lime mud" from the mills of Scotland may be estimated at about 2,000 or 3,000 tons calculated dry.

Composition of Dried Lime Mud.

—	1.	2.	3.	4.
Calcium carbonate	92·64	76·72	70·48	67·40
Calcium hydrate	1·36	9·8	12·82	12·42
Iron and alumina	0·84	0·58	0·70	0·90
Silica	3·50	7·90	10·00	0·75
Sodium hydrate	1·55	4·13	5·30	11·15
Organic matter	0·11	0·87	0·70	7·38
	100·00	100·00	100·00	100·00

Another waste material is bleach mud, consisting of the residue after treating bleaching powder with water to extract its soluble portion, calcium hypochlorite, and which, if it has been properly washed, should consist almost entirely of calcium hydrate. These last traces of calcium hypochlorite are only removed with difficulty, and indeed in most cases are not removed at all. The bleach mud, after receiving its final washing, is settled in tanks or filters, and may contain about 50 per cent. of water, and retain from 0·4 per cent. to 1·5 per cent. of available chlorine calculated in the dry bleach mud.

The quantity of bleach mud produced in a paper mill is not so great as the causticising lime mud. In a mill using 13 tons of bleaching powder per week the quantity produced is about 4 tons dry.

Discussion.

Mr. Cross asked what would be the condition of the fibrous residue as regards moisture and freedom from "dirt," whether Mr. Menzies could put it on the market as a 50 per cent. press cake, and the price at which he could do this.

Mr. Menzies replied that he did not think the residue was free from "dirt," and that he could put it on the market as a 50 per cent. press cake at the price of preparing it.

Mr. Cross, continuing, said that a mixture of that kind was already in use in manufacturing operations, and it fairly clear, he saw no reason why it should not be utilised. He would go fully into the question of the special use of this residue as a personal business matter. Apart from such considerations, he considered that for each of the three residual products dealt with by Mr. Menzies, application might be found in which they should have the value of their main constituents. A well-washed residue from bleach should be used for causticising recovered ash: carbonate residue from the causticising might be used as "precipitated chalk" and he instanced a case in his own experience where a similar residue, after having been "got rid of" for years, was one day the subject of a contract to purchase at a quite respectable price. The second residue, apart from the special use he had in view, might be fractionated by gravity to further separate or concentrate the fibre, and this could then be sold at a proportionately higher price.

Mr. Tod said that a number of experiments had been made by a chemist in the employment of his firm, with a view to discovering some method of utilising the sludge, but that these had been unsuccessful. One of the methods of treatment consisted in subjecting the dried sludge to destructive distillation in order to obtain crude pyroligneous acid, but this was found to be much too costly.

PRIZE COMPETITION.

The Scottish Paper Makers' Association offers prizes to the value of 100*l.* for solutions of the following problems, a full statement of the nature and conditions of which was read by Mr. R. C. Menzies before the Scottish Section of the Society of Chemical Industry.

A prize of 25*l.* to 50*l.*, varying in amount according to the merit of the paper, will be given for each of the following:—

(A).—An investigation of the alkaline liquor obtained on boiling esparto, including a quantitative determination of the principal constituents.

(B).— Methods for the separation in useful forms of the various waste products, viz. esparto liquor, sludge, and lime waste.

(C).— The application of the recovered products to useful purposes in the arts or manufactures.

If only one of the three problems is satisfactorily solved the Committee may recommend that the total sum offered (100*l.*) be given for the successful solution of that problem.

A Committee composed of Mr. G. T. Beilby, Deputy President of the Society of Chemical Industry; Mr. R. C. Menzies, Chairman of the Scottish Paper Makers' Association; Prof. G. G. Henderson, Chairman of Scottish Section of the Society of Chemical Industry; and Mr. Thomas Gray, Hon. Secretary of the Scottish Section of the Society of Chemical Industry, will act as judges of the papers sent in.

Conditions of the Competition:—

In treating of the preparation from the waste materials of useful or marketable products, the suggestions made must be based upon experiment and must be supported as far as ossible by practical results. The Prize Committee may equire any of the experiments to be repeated under test onditions imposed by them. The Committee will not feel ound to award the prizes to papers, however ingenious, hich are merely suggestive unless the suggestions are as lly as possible supported by experimental results. Where e practical realization of the suggestions would involve the onstruction of special machinery or apparatus on a large ale it will be expected that the competitor, when not himself n engineer, will show so clearly the physical and chemical onditions of the operations to be conducted that the ommittee may be in a position without further chemical or hysical investigation to judge as to the necessary steps to e taken for the realization. It is expected that the ompetitor will call attention as fully as possible to the ethods and apparatus in use in other industries which have practical bearing on the practical carrying out of his uggestions.

The competitors may reserve the right to patent the rocesses proposed by them, but must, if they intend to xercise that right, make a statement to that effect.

The papers must be in the English language and typeritten on one side only of foolscap; they must further ear a distinguishing motto or *nom de plume*, but not the ames of the authors.

Each competitor must enclose with his paper a sealed nvelope bearing his motto or *nom de plume* and containing is name and address. This envelope will be opened in he presence of the Council of the Society of Chemical ndustry after the judges have made their award.

The papers and the envelopes containing the slips must e in the hands of Mr. G. Monro Thomson, W.S., 123, eorge Street, Edinburgh, not later than July 1st, 1900.

Applications for samples of the products, with a statement f the quantity desired, should be made to Mr. Thomson, ho will also supply any further information regarding the onditions of the competition.

Meeting held at Glasgow on Tuesday,
November 21st, 1899.

DR. G. G. HENDERSON IN THE CHAIR.

THE RECOVERY OF NITROGEN IN COAL DISTILLATION.

BY W. CARRICK ANDERSON, M.A., D.SC., AND
JAMES ROBERTS, F.C.S.

In the opening sentences of a paper read before this Society in November of last year we drew attention to the large amount of combined nitrogen which is annually being used up in the combustion of coal without being turned to profitable account.

Certain figures, which we then put forward as indicating the possibilities in the way of ammonia recovery that lay before the industries engaged in the destructive distillation of coal, were based upon the expectation of advance along two different lines. The first of these was an extension of the present processes of separating coal into gaseous and fixed constituents (to be subsequently burned apart) with simultaneous recovery of the resulting ammonia and tar. The application of this mode of procedure to even a fraction of the coal at present consumed in the raw state for industrial and domestic purposes would result in a very considerable augmentation of the present supplies of combined nitrogen available for industrial use. The second depended on the possibility of a substantial improvement in the present methods of ammonia production from raw coal in the industries of gas lighting, coke production and iron smelting, which would render available for the market a larger percentage of the nitrogen which is combined in every ton that is daily consumed in these several connections.

Since then, the practicability of extensive development along tho former of these lines has been amply discussed, and we might almost say fully demonstrated, by Mr. Beilby in his presidential address to this Society at its last annual meeting in Newcastle. The installation of central stations from which fuels, solid, liquid, and gaseous, would be distributed according to the requirements of the consumer, would open up the prospect of largely increased supplies of marketable nitrogenous products and especially of sulphate of ammonia.

But while, not only as chemists but as citizens, we must wish God-speed to any such proposal, the time seemed opportune to further inaugurate a discussion which might tend to promote a better understanding of the conditions of ammonia production in the destructive distillation of coal, and so render it possible, perhaps, to obtain large yields per ton than are now the rule.

At present, the commercial supply of sulphate of ammonia is drawn from four sources, but to a very different extent. The latest report of the Chief Inspector of Alkali Works shows that during last year the output of sulphate of ammonia in this country was made up as follows:—

		Tons.
(1.)	From gas works	129,590
(2.)	" shale oil works	37,264
(3.)	" blast furnaces	18,000
(4.)	" Recovery coke ovens	11,568
	Total production	196,422

Of the four sources indicated, Nos. 2 and 3 are probably scarcely to be looked to for any very remarkable increase. At present the production of sulphate at the gasworks enormously preponderates over the other three. Mr. Beilby's calculations show that, were beehive ovens to be entirely replaced by plant of the recovery type, it would probably result in an addition to the fourth item of 110,000 tons per annum, which would bring the aggregate from this source to practically the same figure as the first. Now, without asserting that the complete replacement of beehive ovens by recovery types is an event of the very near future, we are not over sanguine in saying that a comparatively short term of years will see this large tonnage very nearly approached, while, at the same time, should that desirable consummation be reached, to which Mr. Beilby pointed, namely, the manufacture of solid, liquid, and gaseous fuel in large central establishments, we might well see the aggregate from items 1 and 4 grow into a total that at the present moment it would appear fanciful even to mention.

The importance of a thorough understanding of the conditions under which ammonia is obtained from coal is thus apparent. It is an importance which is not to be measured by present-day results, successful in a way, and profitable as these undoubtedly are, but by the enormous future which lies before these industries when the doctrine of economic waste has been brought home as a vital truth to a larger section of the community than at present.

The points we propose specially to consider are:—

(i.) The way in which the nitrogen of coal distributes itself on heating, and the conditions under which ammonia is obtained in retorts and ovens.

(ii.) The limits of ammonia production, and the obstacles in the way of reaching these limits.

Nitrogen in Coal.—It is difficult to say exactly what the average nitrogen content of coal is. Samples differ so much within the narrow limits of, say, 1—2·5 per cent., that it is hardly possible to set down a single figure as the ascertained average.* Excluding anthracites, however, from consideration, analyses we have made of specimens drawn from very various quarters seem to indicate 1·4 per cent. as not far removed from the average figure:—

One ton of coal assaying 1·4 per cent. N. contains 31·36 lbs. N. equivalent to 147·8 lbs. sulphate of ammonia.

From figures quoted by Mr. Beilby it appears that the average yield of sulphate of ammonia per ton of coal is:—

From coke ovens....	19·7 lbs.	– 13·3 per cent. of available calculated on above basis.
" blast furnaces.	20·2 "	– 13·7 " " "
" gas works	22·4 "	– 15·1 " " "

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* With reference to determinations of nitrogen in coal and coke there is little reason to doubt that many of the figures given by the earlier writers are too low.

Overhead the average weight of sulphate recovered per ton of coal is rather under 22 lbs., or about 11½ per cent. of the available nitrogen is obtained in this form. The quantities of nitrogen recovered and recoverable as cyanogen compounds, while forming a fairly large aggregate, work out to such a small figure per ton that for the moment we leave them out of account.

It is further to be noticed that in the three principal industries referred to the quantities of sulphate made per ton of coal treated are by no means the same, *viz.*:—

	Lbs.
Coke ovens	19·7
Blast furnaces	20·2
Gas works	22·4

Moreover, it is hardly to be doubted that, if the yields obtained in various coke, iron, and gas works were set forth for comparison, still more striking differences would be noted.

Coals are mixtures of more or less complex bodies, produced from the degradation of the original constituents of the vegetable substances that went to form them; and one of these bodies at least in every coal is nitrogenous, derived from the primitive albuminous or protoplasmic substances of the plants and their spores. It is this body, or series of bodies, whose behaviour on distillation we have to consider, and the first difficulty that meets us is our entire ignorance of its character and constitution. Tervet, however, has shown (this Journal, 1883, 445, and Jour. of Gas Lighting, 1884, 403), that when hydrogen is brought in contact with nitrogenous bodies at a high temperature, the latter part with their nitrogen more or less freely in the form of ammonia, and in the generality of cases the ultimate result is a complete, or almost complete, conversion of it into this form. The ease with which the separation is effected, however, varies in different compounds; pyrrol and alkaloids do not appear to be so susceptible to the action of hydrogen as other substances; paracyanogen, on the other hand, which initially contained no hydrogen, gives ammonia at once.

Behaviour of the Nitrogen on Heating.—When coals are subjected to a gradually increasing temperature in a closed vessel a considerable loss in weight is experienced before the thermometer reaches 300° C. (W. Carrick Anderson, Proc. Glas. Phil. Soc., 1897; this Journal, 1898, 1027), but in no case have we found any loss of nitrogen to take place under 333° C. Above that limit coals differ ver widely as regards the temperature at which ammonia other basic substances begin to be evolved. The exac determination of these minima directly in the case different coals is rendered somewhat difficult by the varyin duration of the acid reaction, which in most cases is notic able in the distillation process at temperatures betwe 315 and 400 C. In every coal we have tried, howeve the alkaline reaction may be said to start below 480° (The splint and gas coals of Mid-Lanarkshire begin to yiel alkali at what is, comparatively speaking, a low temperatur a fact which has undoubtedly been of great value in relatio to the development of ammonia recovery in the blas furnaces of the West of Scotland. In the case of th strongly caking coals the minimum temperature of ammonia formation is higher than in the Lanarkshire splin and gas, but in all instances of which we have experienc it lies below 470—480 C. The evolution of ammonia when started, continues for a considerable length of time during which the temperature of the charge is steadily rising and even when a quantity of material has been at a red heat for some time, it is possible to detect an alkaline reaction in the gases.

The varying temperature at which the evolution of ammonia begins in the case of different samples of coal would suggest at once that the nitrogenous bodies present in them were different. This conclusion is supported by other evidence as well. For example, the derivatives we have obtained by oxidation of the coals (this Journal, 1898, p. 1018) are apparently different, and, as we shall see hereafter, in other ways the nitrogenous constituents in different coals behave differently.

Nitrogen remaining fixed in Coke.—While this is so, it is an interesting fact that the fixed residues of coals which differ widely in character, and which come from distant localities, contain a very constant proportion of nitrogen, when the residues are prepared in the same way, under identical conditions. In a series of experiments we conducted with reference to this point, two grms. of the finely powdered coal was heated in a covered platinum crucible for exactly two minutes over a strong Bunsen burner, and then, without cooling, for exactly three minutes over the foot-blowpipe. The cooled residues were weighed, and, after being finely ground, the nitrogen was determined in one grm. of the powder.

TABLE I.

Name of Coal.	Nitrogen in Coal.	Weight of fixed Residue (Coke).	Nitrogen in fixed Residue (Coke).	Nitrogen expelled from 100 grms. Coal.	Nitrogen left in Coke from 100 grms. Coal.	Per cent. of original Nitrogen left in Coke.
	Per Cent.	Per Cent.	Per Cent.	Grms.	Grms.	Per Cent.
1. Ell coal	1·53	55·37	1·83	0·517	1·013	66·2
2. Splint coal	1·50	55·14	1·73	0·527	0·973	64·9
3. Kiltongue coal	1·65	55·84	1·77	0·661	0·989	59·9
4. Bannockburn Main coal	1·89	69·93	1·80	0·631	1·259	66·6
5. Kilsyth coking coal	2·04	66·59	1·79	0·849	1·191	58·4
6. Lower Drumgray (Slamannan)	2·12	79·14	1·79	0·693	1·427	67·3

The analyses of these samples of coal are given in our previous paper (mentioned above). 1, 2, and 3 are non-caking bituminous coals; 4 and 5 are well-known caking varieties, while 6 is from a seam which has been partly "burnt" by intrusiye volcanic rock, converting it into a high-class steam coal.

The numbers given in our third column of figures are strikingly large as compared with those that are recorded for certain samples of coke made on a manufacturing scale (Foster, J. Chem. Soc. 1883, 105; and Watson Smith, J. Chem. Soc. 1884, 144). An explanation of the difference at once suggests itself as likely to be found in the fact that very much more rapid heating has taken place in the case of the small sample treated in a platinum crucible, than is possible with a charge of 4½—5 tons in a coke oven or even with one of three cwts. in a gas retort. From the experiments of Tervet, quoted above, the nitrogen of coal is capable of being eliminated completely, or almost so, by the action of hydrogen at a red heat. Time, however, is a necessary factor in the reaction, and in the experiments detailed above the influence of the hydrogen ceased completely in less than five minutes, whereas even in the comparatively rapid process of heating employed for making illuminating gas, a hydrogen atmosphere surrounds and permeates the coal, before it is thoroughly coked, for a much longer period. Much more is this the case in the coke oven, and especially in wide ovens of the beehive type, where a temperature of 350° C. and upwards, sufficient to cause formation and evolution of ammonia, may, and even must, exist for a very long time, especially in the central region before the heat required for complete coking has penetrated from the top or sides.

The figures given in the third column of Table I. show a very striking agreement among the percentages of nitrogen left behind in the fixed residues got on ignition; yet it would not be safe to lay too much stress upon such apparent identities. Although the figures representing nitrogen expelled show a little more variation, they are really of greater practical and even theoretical importance.

Since the nitrogen is expelled though the agency of hydrogen, it might be hastily assumed that the absolute amount thus volatilised ought to bear some approximately constant ratio to the total hydrogen or to the amount of, so called, available or disposable hydrogen in the coal, or even to the amount of volatile matter obtained on ignition. In point of fact, it shows no such relation. And on further consideration it is obvious that we have no real ground for any such expectation. To begin with, even if the composition of the gases from two coals were absolutely identical, the temperature of decomposition in the one case may be very much higher than in the other, and the influence of equal weights of hydrogen on the contained nitrogen will therefore not be the same. Moreover, a "coal" is a complex mixture, and the total hydrogen in one may be made up from sources whose relative values are different from what they are in another sample. The "disposable" hydrogen and even the so-called "combined" hydrogen may be disposed differently, and the volatile matter may be of very different composition in different cases. Take what is known as "isomerism" in coals. Here are two samples, the analyses of which we quote from our previous paper:—

Table II.

—	Gas Coal (Hamilton District).	Upper Drumgray Coal, Sample (1) (Airdrie District).
	Per Cent.	Per Cent.
H	6·11	6·16
C	83·92	83·69
O + Org. S.	8·29	8·36
N	1·68	1·79
	100·00	100·00

The figures for the ultimate analysis are practically identical, but in every other respect the coals are different. The one is the Hamilton gas coal, a non-caking, shaly-looking mineral, with a marked conchoidal fracture, giving on distillation a large yield of gas. The other is a bright, lustrous substance with irregular fracture and of fair caking power. It is from the Upper Drumgray seam in the Airdrie district. But, when ignited, the one gives 2 per cent. more volatile matter than the other, and we can safely affirm that the temperatures at which decomposition will begin, and the form in which the volatile matter will appear under similar conditions of distillation, will not be the same. Hence the action of the hydrogen on the nitrogen contained in the two bodies must necessarily be different to some extent in degree; and, indeed, the gases evolved in the one instance begin to give an alkaline reaction at a temperature 40° lower than in the other. Our former investigations on the derivatives of the nitrogenous constituents of coals seemed to indicate that in different coals we had to deal with bodies, which, although similar, were not absolutely identical in composition, and the position and arrangement of the nitrogen atoms in the original bodies may therefore be assumed to be different.

One other observation we have made in this connection is important. The samples of coal in which the above determinations of nitrogen, fixed and volatilised on ignition, had been made were left in a finely powdered condition in bottles for a period of ten months, and similar determinations were then made upon them. As the result presumably of an alteration in the composition of the coals consequent on atmospheric oxidation, the distribution of the nitrogen on ignition had changed. In both the samples of caking coal it was found that a much larger percentage of nitrogen remained fixed in the coke; in splint coal the amount was the same, while in the Kiltongue it was less than at first.

Table III.

—	Nitrogen (at first).	Nitrogen (after Coal had lain powdered for Ten Months).
	Per Cent.	Per Cent.
Coke from splint coal contained	1·73	1·720
Coke from Kiltongue coal contained	1·77	1·575
Coke from Bannockburn Main coal contained	1·80	2·100
Coke from Kilsyth Coking coal contained	1·79	2·244

A 5 grm. sample of the splint coal, which was found to show the least amount of change in these experiments, was boiled for 60 hours with 300 c.cs. of a 5 per cent. solution of sulphuric acid. The residue was thoroughly washed till free from acid (an operation that required a very long time), then dried at 100° C. and examined. The composition of the sample, as indicated by proximate analysis, remained practically unchanged.

Table IV.

—	Original Coal.	Treated Coal (Dried at 100° C.).	= Calculated on basis of 7·27 per Cent. Moisture.
	Per Cent.	Per Cent.	Per Cent.
Moisture	7·27	0·60	7·27
Ash	2·20	1·42	1·32
Volatile matter	36·22	39·94	37·26
Fixed carbon	54·31	58·04	54·15
	100·00	100·00	100·00

When, however, the fixed residue got on ignition of this sample was assayed for nitrogen, it was found to contain 2·00 per cent. as compared with 1·73 per cent. in the original coal.

The conclusion we arrive at is, that in ordinary practice of ammonia recovery in distillation, the first factor to be considered is the character of the coal itself, and that, even when distilled under identical conditions, different coals will give off variable amounts of nitrogen, and that this is not dependent altogether on the quantities of nitrogen and hydrogen, or of both, which the coals contain.

Effect of Reagents on the Fixed Nitrogen.—The portion of the original nitrogen of the coal which becomes fixed in the carbonaceous residue (amounting in our experiments—Table I.—to 53–63 per cent. of the total) is at the present time unrecovered in any of the industries which deal with the manufacture of nitrogenous compounds from coal. Its presence in the coke, moreover, necessarily lowers the heating power of the latter, and in the blast-furnace diminishes the efficiency of the active gases generated in its combustion by diluting them with a more or less considerable proportion of free nitrogen.

In these circumstances it seemed worth while to try the effect of certain reagents in eliminating this nitrogen, and the results are interesting, even if they do not offer very much encouragement. The splint and ell coals were selected as examples of the non-caking class, and Bannockburn Main and Kilsyth Coking as typical caking coals.

(*a*.) One grm. of the sample, in powder, was thoroughly mixed with 5 c.c. of a 10 per cent. solution of caustic soda (= ·5 grm. NaOH) in a platinum crucible. The mixture was then evaporated to complete dryness, and the residue ignited under exactly the same conditions as described above. A determination of the total nitrogen in the residue was then made. (*b*.) One grm. of the sample was mixed with 10 c.c. of milk of lime, containing 0·5 grm. CaO, and the mixture evaporated to dryness and coked as before. (*c*.) ·66 grm. Na_2CO_3 (= ·5 grm. NaOH) was substituted for the caustic soda in the first set of experiments. The results obtained are shown in Table V.

The residue from one gram splint, which had been treated with a mixture of ·5 grm. Na_2CO_3 in solution and ·5 grm. $Ca(OH)_2$, contained ·0115 grm. nitrogen = 76·7 per cent. of the original nitrogen in the coal.

Table V.

Name of Coal.	Nitrogen in Coal used.	Nitrogen in Coke from untreated Coal.	Percentage of original Nitrogen in Coke.	Nitrogen in NaOH Coke.	Percentage of original Nitrogen in NaOH Coke.	Nitrogen in $Ca(OH)_2$ Coke.	Percentage of original Nitrogen in $Ca(OH)_2$ Coke.	Nitrogen in Na_2CO_3 Residue.	Percentage of original Nitrogen in Na_2CO_3 Coke.
	Grms.	Grms.	Per Cent.	Grms.	Per Cent.	Grms.	Per Cent.	Grms.	Per Cent.
Splint coal	0·0150	0·0095	63·3	0·0018	12·3	0·0097	64·7	0·0148	98·7
" "	..	..	..	..	.	0·0097*	64·7	..	..
Ell coal	0·0153	0·0101	66·0	0·0036	23·5	0·0116	75·8	0·0140	91·5
Bannockburn Main coal .	0·0189	0·0125	66·1	0·0140	74·0	0·0126	66·7	0·0158	83·6
Kilsyth Coking coal	0·0204	0·0119	58·3	0·0174	85·3	0·0144	70·6	0·0156	76·5

* Lime water was used instead of milk of lime.

These figures present two very remarkable features: (1) a fairly complete elimination of the fixed nitrogen is effected by caustic soda in the case of the non-caking coals, but none at all in the caking varieties; (2) carbonate of soda causes in every case a further fixation of nitrogen, and in the non-caking coals this is equal to over 90 per cent. of the total nitrogen content of the coal; (3) slaked lime produced in all cases very little result, but invariably showed a tendency towards fixing additional nitrogen in the coke. Blank experiments had proved the absence of any estimable quantities of nitrogen in the reagents used.

Whatever amount of stress we are to lay upon these results, they establish at least a distinct difference between the nitrogenous bodies in the caking and non-caking coals in one particular, namely, their behaviour towards caustic soda at a red heat. But to what is the marked difference of action of sodium hydrate and sodium carbonate to be ascribed, and at what stage in the heating process does the liberation of the nitrogen by the former reagent take place? To throw some light on this point, one grm. of splint was fused for 45 minutes with 10 grm. of caustic potash in a silver basin at a temperature just sufficient to keep the mixture liquid. After cooling the mass, it was found to contain ·0148 grm. of nitrogen (N in original coal = ·0150 grm.) so that at that temperature, even prolonged contact with fused alkali had failed to convert any appreciable part of the nitrogen into volatile compounds.

Ignition with excess of sodium carbonate had shown in every case a fixation of the nitrogen which would have been set at liberty under ordinary conditions; in the case of the caking coals caustic soda produced a like result. The question suggested itself, Is the extra nitrogen thus fixed in the form of soluble or insoluble compounds? To ascertain this, one grm. of splint was treated as before with soda carbonate and ignited. The residue was then completely extracted with hot water, washed and dried. The dry extracted residue still contained ·0095 grm. of nitrogen, *i.e.*, the same quantity as it was found to hold when ignited in the ordinary way. The filtrate from the insoluble residue contained sodium cyanide equivalent to ·0022 grm. of nitrogen, and a small quantity of sulphocyanide which was not determined.

Liming of Coal.—In 1883 attention was called by Mr. J. Alfred Wanklyn (Brit. Assoc. Rep. 1883, p. 471; this Journal, 1883, p. 438, and 1884, p. 12), to a process patented by Mr. W. J. Cooper, for increasing the yields of tar and ammonia in the distillation of coal by "liming" the coal. "Limed coal is made by taking quicklime, slaking it, and thereby getting it into a state of fine division, and mixing the finely divided slaked lime with the coal." The proportions recommended were slaked lime equivalent to 2½ parts quicklime to 100 parts of coal. Regarding the utility of the liming process, the evidence of gas engineers was of the most contradictory character. At Beckton Gas Works the increase in ammonia recovery was reported to be 36 per cent., at the Commercial Gas Works 27 to 28 per cent., at Cheltenham 20 per cent. Mr. Cooper himself stated that experiment had proved the gain in ammonia to vary from 20 to 100 per cent. On the other hand, the Old Bankside Works of the South Metropolitan Company reported no gain of ammonia while using the process, and this result was confirmed at the Vauxhall works of the same Company, where no improvement was noted although 30,000 tons of coal were treated by the process.

Now, in the face of positive statements by well-known engineers that in the works under their control an increased quantity of ammonia was recovered while the process was in operation, it would be idle to deny that, in the case of certain coals at least, an admixture of slaked lime produces an effect in the distillation. But our experiments detailed above show that, in the case of these typical Scotch coals at least, the nitrogen which under ordinary conditions of distillation remains fixed in the coke, is not liberated in any form by distillation with lime even when the latter is employed in a much greater proportion than could be suggested for use in any commercial process. The augmentation of ammonia, when it occurs, is therefore apparently to be ascribed to an effect produced on that part which is set free even under ordinary conditions of distillation, and which may ultimately appear either in the form of ammonia or of free nitrogen. In this case the action of the lime would consist in altering the rate of conductivity of the charge, and also, it may be, in setting free the elements of water above a certain limit of temperature, which, diffused through the gases, might aid in maintaining the stability of the alkali.

Apart altogether from the results of our experiments, it is impossible to conceive that the lime, mixed as it was in the original process with the coal by hand or mechanical means, could exercise any great influence on the fixed nitrogen of the coal. Unless the two were ground together to the state of an impalpable powder, the non-volatile and infusible earth must necessarily have failed to reach anything more than a fraction of the nitrogenous molecules present in the charge.

A like objection applies to every attempt (and how numerous have been the suggestions!) to remove this residual nitrogen from coke by steaming or application of external reagents after the coke is made. Metallurgical coke as Thorner's microscopical researches have shown (Stahl und Eisen, 1886, p. 77), is a mass of cells, the walls of which are thoroughly vitrified and gastight. Steam, except in so far as it burns away the carbon of the coke, scarcely comes in contact with the nitrogenous constituents of the latter, protected as they are by this impervious coating.

Nitrogen set free from Coal.—From the experiments described above it appears that when small quantities of coal are distilled, a fairly constant percentage of the total nitrogen remains behind in the fixed residue, averaging about 64 per cent. The balance of about 36 per cent. is set free in three forms, alkaloidal and other nitrogenous bodies in the tar, ammonia in the liquor and free nitrogen in the gas.

The quantity of nitrogen in the tar is affected greatly by the temperature of distillation. Watson Smith (Chem. Soc. Journ. 1884, p. 144; this Journal, 1884, p. 234) gives 1·667 per cent. as the quantity found in a sample of (high temperature?) tar. A sample of Scotch splint, distilled at a fairly low temperature, we found to yield a tar containing 1·11 per cent. of nitrogen. If we take the yield of tar as being about 10 per cent. of the weight of the coal, and regard it as containing on an average 1·4 per cent. of nitrogen, this would represent ·14 per cent. nitrogen calculated on the weight of the coal itself. Assuming again that this latter contains 1·4 per cent. nitrogen altogether, the amount found in the tar is equal to 10 per cent. of the total.

Watson Smith's calculation of Foster's results (Chem. Soc. Journ. 1884, p. 144; this Journal, 1884, p. 234) shows 48·68 per cent. of the nitrogen in the coke: Knublauch (this Journal, 1896, pp. 106, 107) gives the average figure for Westphalian coal as 50 per cent. in the coke, and these, for reasons we shall afterwards give, we regard as nearer the average figure under practical working conditions than the 64 per cent. which we found in cokes got by rapidly igniting small quantities of coal in a platinum crucible.

These two items then, taken together, account for 60 or at the most 65 per cent. of the total nitrogen. The balance of 35—40 per cent. comes off as ammonia and free nitrogen in the gases. Regarding the quantity ordinarily making its appearance as ammonia, there is a remarkable unanimity in the evidence from all sources. The average yield of sulphate per ton of coal distilled in this country we have stated to be about 22 lbs., equivalent to 4·67 lbs. of nitrogen, or, in other words, ·21 per cent. of the coal is represented by nitrogen, which is evolved and collected as ammonia. If we regard 1·4 per cent. as the average nitrogen content of the coal distilled, this result would be equivalent to 15 per cent. of the total nitrogen present.* Carefully conducted distillations of specimens of Scotch and English splints gave us in the laboratory 19·6 per cent. and 18 per cent. respectively. For Westphalian coals, Knublauch (*supra*) quotes 12—14 per cent., and Foster's results for English coals show 14·5 per cent.; E. Schilling (this Journal, 1887, p. 652) gives 15·1 per cent., while Tichauer states (this Journal, 1895, p. 143) that the figure varies from 13 to 24 per cent.

Fifteen per cent. may therefore fairly be regarded as a close approximation to the actual practical yield of ammoniacal nitrogen. The balance unaccounted for is about 25 per cent., and with the exception of a very small quantity, which appears as cyanogen compounds, this large proportion exists as free nitrogen in the gaseous products of distillation. It is present in estimable quantity in all coal gas, and L. T. Wright has shown that Newcastle gas contains 2·8 to 3·4 per cent. of nitrogen, when every precaution has been taken to exclude air.

To account for the presence of this free nitrogen among the gaseous products of distillation, it is necessary to recall the fact, to which we have already alluded, that the decomposition of the nitrogenous part of coal with formation of ammonia begins in the different specimens only when they are heated to over 375° C. and in many cases not till a very much higher temperature is reached. But it has been shown by Ramsay and Young (Journ. Chem. Soc. 1885, p. 89) that under favourable conditions, ammonia begins to dissociate at a temperature slightly under 500° C., and that the decomposition is complete at 780° C. Since, therefore, under the ordinary conditions of destructive distillation, the temperature of the charge is continually rising, it is inevitable that a considerable part of the decomposition of the coal must take place at a temperature sufficiently high to admit of more or less of the resulting ammonia being dissociated in contact with heated surfaces. No doubt this decomposition will be retarded to some extent by the presence of a protecting atmosphere of hydrogen and hydrogen-containing gases, but at higher temperatures it will not be altogether prevented. On the other hand, carefully conducted experiments have shown us that so long as the distillation is carried on at temperatures below 500° C., no part of the nitrogen contained in the coal makes its appearance in the free state. For example, when 3 grms. of Scotch splint coal was distilled for three hours at a temperature varying from 440° to 470° C., the nitrogen of the coal (1·50 per cent.) distributed itself in the manner shown in Table VI.

If a small sample of coal which has been ignited for five minutes over the blowpipe in a closed vessel so as to expel its volatile matter be tested for nitrogen it will be found that, even although kept at a bright red heat for five or six hours, no further portion of the nitrogen remaining is expelled, thus:—

TABLE VI.

——	Nitrogen.	Percentage.
	Grm.	
In the coke (= 1·93 grms.)...............	0·03540	78·67
In the aqueous distillate as ammonia	0·00476	10·58
In the tar (= 0·41 grm. containing 1·11 per cent.).	0·00455	10·11
Total nitrogen found.............	0·04471	99·36
Total nitrogen in coal used.......	0·04500	100·00
Balance unaccounted for....	0·00029	0·64

TABLE VII.

——	Sample "A."	Sample "B."
	Per Cent.	Per Cent.
Nitrogen in coke (5 min.)........	2·19	2·10
Nitrogen in coke after $6\frac{1}{2}$ hours at red heat.	2·14	2·18

On the other hand, when a quantity of coke from sample "B" which had already been heated for $5\frac{1}{4}$ hours was subsequently heated to redness in a stream of hydrogen gas for six hours, it parted with 17·27 per cent. of its nitrogen in the form of ammonia.

TABLE VIII.

		Grm.
Nitrogen in 0·7 grm. of coke from sample "B"		0·01526
Nitrogen collected as ammonia on passing hydrogen over this for six hours at red heat	Grm. 0·00266	
Nitrogen found in the residue	0·01274	
		0·01540
Experimental error........		0·00014
		= 0·9 per cent.

From the results of these experiments it seems exceedingly improbable that any part of the nitrogen of coal is liberated in the distillation process as free nitrogen, and its invariable presence in the gaseous product may therefore be set down to a more or less extensive dissociation of the previously formed ammonia in contact with heated surfaces. It was pointed out by Ramsay and Young that the rate of such dissociation was influenced both by the extent and the character of the heated surface as well as by the time of exposure to its action. In general, a rough surface may be said to facilitate the decomposition. There can be little doubt that these causes operate to some extent in gas retorts and very powerfully in coke ovens. In the latter, the ammoniacal gases being evolved from the central portions of the charge, have to make their way to the exit tube through a layer of partially coked material, which is already at a fairly high temperature. The conditions, so far as the roughness of the solid surface and the rate of passage of the gas are concerned, are almost ideal for bringing about dissociation to the utmost extent, and go a long way to explain the fact that, while for the whole country the average yield of sulphate from gasworks is 22·4 lbs. per ton, that from coke ovens is only 19·7 lb.

Ammonia in the Blast Furnace.—The recovery of ammonia from the gases of the blast furnace presents itself as a special case of what is carried on in the gas works. Apart from the engineering difficulty of dealing with the 130,000 cubic feet, or thereby, of gas per ton as against some 10,000 in the gasworks, the process would present no extra difficulty, were it not for one factor which has hitherto been most remarkably ignored. So far as avoiding the danger arising from simple dissociation of the alkali is concerned, the gradual descent of the charge in the furnace admits of distillation being carried on for a fairly lengthy period at a low temperature, as compared with that obtaining in the gas retort, while, since the gas in rising is continually passing into zones of diminishing temperatures, the alkali does not here incur the risk of dissociation to the same extent as in making its escape from the coke oven. Yet we find that the average yield from blast furnaces is only 20·2 lb. as against 22·4 from gas works. What is the reason?

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* Taking the different sources separately, it would work out: Coke ovens 13·3 per cent., Blast furnaces 13·7 per cent., Gas works 15·1 per cent.

A long-continued series of experimental trials established conclusively that the presence of iron ore in the distillation charge was responsible for a very serious falling off in the yield of sulphate of ammonia, and that this was brought about by oxidation of the ammonia by the oxide of iron, a reaction which begins at a fairly low temperature.

A sample of splint, which gave, when distilled, about 31·65 lb. of sulphate of ammonia, yielded when treated as nearly as possible under the same conditions of temperature, but in the presence of calcined clayband ore in the proportions of an ordinary blast furnace charge, only 23 lb. of sulphate. Another coal, similarly treated, gave

	Lbs.	
When distilled alone	30·73	Am. Sulph. per ton.
When distilled with ore "A" ...	17·41	„ „ „
When distilled with ore "B"....	17·97	„ „ „

In order to determine the rate at which this destruction of ammonia proceeded at different temperatures, an independent investigation was set on foot which showed that the action begins at a fairly low heat, and rapidly increases as the temperature rises. The complete figures will be communicated to the Society at an early date.

From these experiments it is obvious that the presence of the ore in the upper part of the blast furnace cannot be regarded as a negligible quantity in weighing the different factors that contribute to the result. Too much stress may, of course, be placed upon the figures representing the destruction of ammonia in passing it alone over heated iron ore. The conditions in such an experiment are not identical with those obtaining in a blast furnace where the alkali is protected by an atmosphere of hydrogen and hydrogen compounds. Still, the distillation experiments, described above, which were done under conditions somewhat resembling those obtaining in practice, show that a serious falling off in the yield of sulphate of ammonia may result from the operation of this cause.

Summary.—We may now gather up the conclusions which we are inclined to regard as the result of these experiments—

(1.) When coal is heated, part of the nitrogen contained in the nitrogenous constituent comes off as ammonia in the gases, part goes to form nitrogenous compounds in the tar, the rest remains fixed in the solid residue or coke.

(2.) The percentage which is thus evolved as ammonia is dependent partly on the structure of the nitrogenous constituent of the coal, as well as on two other factors, the amount of hydrogen available to combine with and carry off the nitrogen, and the period during which the nitrogenous body is exposed to the influence of the hydrogen above a certain limit of temperature.

(3.) Heating the nitrogen-containing body has no effect alone in dislodging the nitrogen; there must be a simultaneous action of hydrogen or certain hydrogenized compounds.

(4.) The presence of free nitrogen in the gases got from distillation of coal, amounting frequently to 25 per cent. of the total nitrogen of the coal, is due to dissociation of the ammonia at temperatures over 500° C.

(5.) The amount of this dissociation is increased by rise in temperature and by increase in the time during which the gas is exposed to the heat. For this reason, although in a coke oven the charge is subjected to a more gradual heating than in a gas retort, the quantity of ammonia recovered may be actually much less than in the latter case, because in the coke oven the ammonia liberated in the lower part of the charge is subjected to dissociation conditions for a longer time in passing upwards through a thick crust of strongly heated coke.

(6.) In blast furnaces the oxide of iron exercises a destructive effect on the ammonia at comparatively low temperatures, and while, owing to the very gradual descent of the raw coal towards the hotter region of the furnace, a considerable part of the ammonia will be formed and escape before the limit of dissociation is attained, yet the influence of the oxide of iron in the ore, which is active at very much lower temperatures, may be such as to more than counterbalance the benefit derived from these favourable conditions, and bring out the average yield of sulphate at a lower figure.

Discussion.

Mr. Wallace Thorneycroft sent a contribution to the discussion, in which he briefly traced the development of the by-product coke oven, and gave the following details:—

The modern by-product coke oven is a rectangular chamber from 25 to 35 ft. long, 5 ft. 6 ins. to 6 ft. 6 ins. high, and 12 to 24 ins. wide, built of good fire-bricks. In the side walls of the ovens are built flues and here the gases are burnt. It is in the design of these flues and the method of burning the gases that the various types differ, but as each of the patentees publish pamphlets setting forth their methods and the advantages claimed, I do not propose to describe any of them, the chief difference being that some have horizontal flues, some vertical, some have thin bricks next the ovens with a strong division wall between each oven to carry the topweight, while others have thick strong bricks forming the sides of the oven. Heated air is sometimes used for burning the gases. The object aimed at by all is to make a durable and gastight chamber, the inside walls and bottom of which can be always maintained at a uniform temperature of from 2,000° to 2,500° F., and provide means to carry off the volatile products as rapidly as possible.

These are the essential features of successful production of good coke for metallurgical purposes, subject of course to the coal treated being of suitable quality and well prepared.

In some plants the volatile products are drawn through a hydraulic main and in others into a simple pipe and thence to the condensers and scrubbers, a valve being provided in all cases to isolate each oven during the time it is being drawn and charged. The raw fuel is usually crushed so that the bulk of it would pass through a ⅜ in. mesh, and is also usually washed, so that it contains from 8 per cent. to 15 per cent. of added water. Sometimes the crushed coal is charged into the oven by an apparatus that admits of it being compressed.

The amount of nitrogen recovered as ammonia from the coal by washing the gas with water varies from 15 per cent. to 24 per cent. of the total nitrogen originally contained by the raw fuel, and about 50 per cent. remains in the coke. So far no method has been discovered of eliminating this without destroying the coke. A small amount of nitrogen, 1 per cent. to 1½ per cent. of the total nitrogen in the coal, has been recovered as cyanide, but up till now the recovery of this by-product has not been commercially successful. Further small quantities of cyanogen compounds are present in the ammonia liquor, and those interested in them will find information about them in the reports of the Inspector of Alkali, &c. Works.

Accurate statistics of the coke industry are not available, but probably about 35,000,000 tons of coal were made into coke last year in the United Kingdom. Of this about 1,100,000 tons were coked in by-product ovens; 1,900,000 in Coppee ovens, and the balance 32,000,000 in beehive or rectangular ovens.

The first cost of a coking plant with by-product recovery is large, and in some cases the up-keep is costly. The steam generated by the waste heat of a by-product installation is not sufficient to work the whole plant including crushing and washing the coal. The initial cost of an installation for production of coke without by-product recovery is very much less, and the steam generated admits of a surplus being used for other purposes. The management of the by-product installation requires more skill and care, and the cost of working is higher. The coke produced from the same coal by either system will do practically the same amount of work per ton of coke assumed, if the by-product installation is efficiently designed and managed. It is therefore clear that the value of the by-products recovered is not all profit.

Mr. Foulis said that the subject of the paper was of very considerable interest to gas manufacturers. About 20 years ago Prof. Foster made the experiments that Dr. Anderson had referred to, and the results obtained agreed very closely with those given by Dr. Anderson. Prof. Foster showed that of about 1·7 of nitrogen in coal only about 0·25 per cent. was recovered in the form of ammonia, and of the balance about 50 per cent. was left in the coke. Another point proved by his experiments, which also agreed with the statement made in the paper, was that the bulk of the ammonia was evolved during the earlier part of the period of carbonisation, very little being evolved at the later stage when the temperature in the retort was higher, and when, no doubt, decomposition of the ammonia took place as had been suggested. Subsequent experiments had also shown that cyanogen compounds were liberated in the latter period of the charge, whilst there was very little of the cyanogen compounds in the earlier period. Since those experiments were published a great many attempts had been made to recover the nitrogen which was thus lost. On the experiment of liming the coal in the retort which had been referred to, a great deal of time and money was spent, but it was an utter failure, and he could not help thinking there must have been some error made in those experiments that showed such a large percentage of increase of ammonia, because the coals used in all the works where the process was tried were very similar in quality, and the difference in the result obtained could not arise from this cause. Since that time experiments had been tried for the purpose of recovering the nitrogen which was left in the coke, by passing steam through the red hot coke after the gas was eliminated, and he believed with some degree of success, but whatever the success was experimentally, it had not proved commercially successful and he did not know of any such process now being carried on. He thought the quantity of ammonia given off in the retort, depended a good deal on the state of the coal. He was of opinion that wet coal yielded a larger quantity of ammonia than dry coal, but he had no definite data to go upon. The recovery of nitrogen eliminated in the form of cyanogen had occupied his attention to a considerable extent for several years. It was exceedingly doubtful in what form it existed in the gas. Prof. Foster proved that when the gas was passed through the lime purifiers, if the lime was in a damp state the cyanogen was converted into ammonia, and this was a fact which was well known from experience in daily practice. Several years ago he commenced a number of experiments which in the end proved successful, and they now recovered cyanogen in the form of ferrocyanide of soda by simply passing the gas, after the ammonia had been eliminated from it, through scrubbers in which an iron salt was maintained in suspension in an alkaline solution of soda or potash, and in that way they got cyanogen in the form of ferrocyanide of soda or potash, and free from sulphur. An amount of cyanogen equivalent to from 3½ to 4 lb. of crystallised ferrocyanide of soda per ton of coal carbonised was thus recovered.

Mr. Beilby said that in his experience the differences in the physical structure of the various kinds of coal had an important influence on the distribution of the nitrogen during and after distillation. Splint, cannel and coking coals in their natural state show obvious differences of structure. After the coals are coked these differences are accentuated. Splint and cannel not only retain the outward form of the original coal, but also, to a considerable extent, its organised structure. Therefore their porosity is akin to that of charred wood and other vegetable remains. In second-class cannels as well as in oil shales the mineral matter adds considerably to the porosity of the residual coke. It seems probable that the extent of red-hot surface over which the more complex nitrogenous products of the coal have to pass during distillation will largely determine the proportions in which free nitrogen, ammonia and nitrogenous bases will appear among the products of distillation. Anyone who has attempted to decompose these basic substances so as to obtain their nitrogen as ammonia must have recognised the all-powerful influence of surface on the decomposition. In order to completely resolve the basic tars from peat into ammonia Grouven found it necessary to pass the vapours over a specially prepared porous material to which he gave the name of "Contact Masse." No doubt, as Dr. Anderson pointed out, the primary nitrogenous substances of the different kinds of coal may be more or less easily decomposed; but it seems perfectly clear that the *conditions* which influence the decomposition are to a considerable extent to be found in the physical structure of the coal itself.

Mr. H. Bumby said that Dr. Anderson's paper had cleared up several points which had puzzled him and others who were working at the subject on a large scale. He thought that Dr. Anderson's statement of the yield of ammonium sulphate from the blast furnace—viz., 20 lb. per ton of coal—was probably approximately correct for the whole country, but that in the district specially under consideration (Lanarkshire), he believed the average yield would be about 23 lb., and he knew of cases in which it was considerably larger. He mentioned several sources of loss of nitrogen, and referred firstly to the gas which escaped on lowering the furnace bell. He had recently spent some time trying to determine that loss, and had found it to vary from 2½ to 5 per cent. of the total gas, and thought it probably generally approached 5 per cent. There was also a small loss from combustion round the bell, and on account of the pressure maintained at this point to avoid risk of explosion. Lastly, it was the general practice to clean out the flue dust through small holes in the gas tubing whilst the furnaces were working, and some loss of gas was occasioned in that operation. He thought that all these would together cause a loss of from 8 to 10 per cent. of gas and a corresponding loss of ammonia. There was also a very small loss of ammonia which escaped condensation and of combined ammonia, lost in the lees water, though these together should not exceed 0·5 to 0·6 per cent. of the total. Adding these losses to the amount actually recovered gave a total of ammonia, present in the gases as they leave the top of the blast furnaces, somewhat exceeding what might be expected from Dr. Anderson's experiments, and he asked whether the authors had fully considered the influence of the steam and hydrogen present in the blast furnace on the evolution of ammonia. With regard to the effect of iron ore, he asked whether the experiments were conducted with dry materials or in an atmosphere of steam and hydrogen such as existed in the blast furnace. The bulk of the ores used at the present time consisted of hydrated ferric oxide, often in large lumps, and they carried down a portion at least of their combined water to a part of the furnace below that at which the bulk of the ammonia was evolved. The splint ore also contained a considerable percentage of water which probably helped to form a protective atmosphere for the ammonia. The total amount of water condensed from the gases often amounted to 30 per cent. of the weight of coal used, and the gases contained from 7 to 8·3 per cent. by volume of hydrogen. The change in the nitrogen compounds in coal on exposure to air explained the loss of ammonia which was always experienced on using "bing" coal which had been lying exposed to the atmosphere for a long time. Referring to Mr. Foulis' remarks regarding the formation of cyanogen, Mr. Bumby stated that a similar observation was made in the blast furnace. Cyanogen was evolved at the tuyeres, and fumes of alkaline cyanides were frequently found at the tuyère arches. Higher up in the furnace the cyanogen was decomposed and helped to reduce and carburize the iron. A small sublimate of alkaline cyanides was, however, sometimes found at the top of the gas tubes in coke furnaces, though he had so far been unable to detect it in coal-fed furnaces.

Mr. Lean said that he had been recently engaged, in conjunction with Dr. Anderson, in investigating the destruction of ammonia in contact with iron ores, and hoped to be able to communicate the results of their experiments to the Society at an early date. The destruction of the ammonia, under the conditions of their experiments, was very marked above 260° C.; at 280° C. it amounted to at least 75 per cent. of the ammonia passed over the ore, and at temperatures above 300 complete decomposition of the ammonia seemed to have been effected.

Mr. Robert Hamilton said that he found it difficult to reconcile the results of Dr. Anderson's experiments with those obtained by Mr. Bumby on a large scale. Dr. Anderson had stated that a coal which gave about 31 lb. of sulphate on distillation in the laboratory only yielded 22 lb. when distilled in presence of iron ore, a result which showed a very considerable loss, while Mr. Bumby had pointed out that some furnaces were giving over 25 lb., notwithstanding the considerable loss of gas to which he had referred in the course of his remarks. He (Mr. Hamilton) had carried out some experiments on the distillation of coal with iron ore in a manner similar to that described by Dr. Anderson. He directed his attention more especially to the preservation of the tar, and found the difference between the results of his experiments and those obtained in practice to be even more striking than that mentioned above. When the coal was distilled with iron ore in the proportions in which it was charged into the blast furnace in some cases only a quarter, and in others a third or at most a half of the tar was recovered. These results, which were obtained with English ore and English coal, as well as with Scotch splint coal and Spanish ore, were altogether different from those got on a large scale. He thought that the preservation of the products from the blast furnaces depended on a factor which had hardly been alluded to. Dr. Anderson had referred to the protecting nature of the gas consisting largely of hydrogen and water vapour, but no reference had been made to the rapid flow of gas from the top of the furnace. In one case he had made a calculation of the rate of flow of the gas, and had found it to be approximately 80 lineal feet per minute. He thought that the removal of the products of distillation due to this rapid motion of the gases at the top of the furnace explained the fact that the recoveries in practice were much better than laboratory experiments would lead one to suppose.

Dr. Anderson, in reply to Mr. Beilby, said that in the samples they had used the variation in ash would scarcely affect the result, since they were all selected clean nuts in which the ash was always under 2¾ per cent., and were all chosen to allow of them working on pure material. Mr. Beilby had referred to the influence exerted on the distribution of the nitrogen by the form and structure of the coked residue. The view he had expressed, that it materially affected the final result, was no doubt correct, and they had already indicated that such was the case in the part of their paper dealing with the conclusions arrived at by Ramsay and Young regarding the dissociation of ammonia. Regarding Mr. Bumby's remarks relative to the amount of nitrogen recovered as ammonia in Lanarkshire compared with the country generally, he said that they had referred to that point in an early part of their paper. Lanarkshire splint was one of the coals which gave off its ammonia at the lowest temperature, and under those conditions a large percentage of the ammonia evolved had a chance of escaping from the top of the furnace before the action of the ore came vigorously into play. On the other hand, there were coals from which the evolution of ammonia began at a considerably higher temperature, and in such cases the risk of destruction of the alkali of the raw ore was much increased, and the amount of ammonia dissociated would also be greater. The statement that the average quantity of ammonia recovered in Lanarkshire was larger than that which they had quoted for the whole country was certainly correct; but, on the other hand, the average percentage of nitrogen contained in Lanarkshire coals, so far as they had examined them, was higher than the average of 1·4 per cent. which they had adopted for the bituminous coals over the whole country. Regarding the experiments of distilling coal mixed with raw iron ores, they did not profess to have imitated exactly the conditions obtaining in the upper part of a blast furnace. The experiments had been conducted both with hydrated and with calcined ores, and the destruction of ammonia appeared to be greater in the latter than in the former case, so that the water which was evolved in the case of the former seemed to have the effect of protecting the ammonia to some extent. The rapidity with which the gases escape from the furnace had been mentioned as probably exercising some influence on the result, and Dr. Anderson pointed out that the authors had stated in their summary that time was a factor in all the actions by which ammonia was formed and destroyed.

Obituary.

EDWARD C. C. STANFORD.

PRESIDENT OF THE SOCIETY (1893–1894); FIRST CHAIRMAN OF THE SCOTTISH SECTION.

Edward Charles Cortis Stanford belonged to an old Sussex family, and was born at Worthing on February 23rd, 1836. He was educated at All Saints' College, Maidstone, which he entered in 1849 (where the late Rev. C. H. Spurgeon was his schoolfellow), and afterwards at Craufurd College, Maidenhead. At an early age he showed great talent for chemistry, and gained first prizes in that subject in both the above colleges. In 1852 he joined his father (one of the founders of the Pharmaceutical Society) at Worthing, and as his pupil devoted five years to the varied departments of Practical Pharmacy, during which time he delivered some lectures on chemistry at the Worthing Institution. At the end of that time he spent ten months under Prof. Redwood in the Pharmaceutical Society's Laboratory. He had already devoted himself to the study of photography, his first communication being to the Journal of the Photographic Society of Nov. 12th, 1856, "On Fixing by Chloride of Platinum"—a subject which has since become commercially important. In 1858 he passed with credit the Minor and Major examinations of the Pharmaceutical Society, and was admitted a member in 1860. He held the post of Professor of Chemistry in Worthing College for two years, and of Lecturer on Chemistry and Physics in Craufurd College for one year; and in September 1862 he was appointed Assistant Demonstrator in Chemistry and Pharmacy in the Pharmaceutical Society's Laboratory under Prof. Redwood. In Nov. 1862, and again in 1884, the Society of Arts awarded him their silver medal for his paper on the "Economic Applications of Seaweed," and at the International Inventions Exhibitions at London (1862, 1873, 1875, 1885), Dublin (1865 and 1872), Paris (1867 and 1878), Havre (1868), and Vienna (1873), he obtained medals for the chemical products obtained by his patented process. The Graham Gold Medal, given triennially, for the best technical research in chemistry, was awarded to him in 1884 for his research on seaweed and discovery of the new substance "Algin." He was one of the first presidents of the Chemical Section of the Glasgow Philosophical Society; also the first Chairman of the Glasgow and West of Scotland Section of the Society of Chemical Industry (1884).

Mr. Stanford's paper on the "Economic Applications of Seaweed," read before the Society of Arts, attracted the attention of the Duke of Argyll, and led to his (Mr. Stanford's) going to reside in Scotland in 1863. He then went to Tiree to work up the kelp industry, and remained there 18 months, after which time he went to Clydebank, and, along with others, established the British Seaweed Company's works at Whitecrook, of which he was appointed manager. When the North British Chemical Company (now the British Chemical Company, Ltd.) was formed, Mr. Stanford was made managing director, and he has been associated with these works at Clydebank for the last 35 years. He also wrote a great deal about the Highlands and Western Islands, with which he was connected for fully 36 years, and in some of which he established large works, notably at Middleton, Tiree, and Loch Eport, North Uist. He was associated, moreover, with Ireland and Norway in collecting tangle to form kelp, the collection of which gives lucrative employment to the crofters and others.

One of Mr. Stanford's later researches enabled him to form "Alginoid Iron," a combination of iron with alginic acid, which has been found to be of therapeutic value, the compound being more readily assimilable than the other salts of iron, and being laxative instead of astringent. His last research was on the active principle of the thyroid gland, and it resulted in the formation of "Thyroglandin," used in cases of obesity and myxœdema. The results of the last two investigations were communicated to the meeting of the British Pharmaceutical Conference at Belfast in 1899.

For some years Mr. Stanford was Chairman of the School Board in Clydebank, and took a great interest in the large school which exists in that town. He was also Chairman of the Rivers Pollution Committee, and one of the Governors of the Glasgow and West of Scotland Technical College; and he was Chairman of the Vanduara Silk Company, a new undertaking, which has for its object the making of silk from gelatin.

Mr. Stanford was a man of very wide culture, and his genial and kindly disposition won him the respect and esteem of all who knew him. He was always ready to help others, and his humorous vein made him popular in all societies.

The following is a list of his published papers:—

"Fixing by Chloride of Platinum." Nov. 1856. Journal of Photographic Society.

"Researches on Atmospheric Ozone." June 1860.

"Salt Efflorescences." April 1860. Chemical News.

"The Concentration of Alcohols in Bladders." March 1861. Chemical News.

"The Economic Applications of Seaweed." Feb. 1862. Society of Arts.

"The Manufacture of Kelp." Journal of the Pharmaceutical Society, Vol. III., 1862. (This paper also appeared in Chemical News, Technologist, Chemist and Druggist, and Repertoire de Chémie.)

"Marbles from the Island of Tyree." British Association, Liverpool Meeting.

"A Chemist's Views of the Sewage Question." Glasgow Sewage Association, March 1868. (Also read before the Chemical Section, Glasgow Philosophical Society, April 1869.)

"Chemical Method of Treating Excreta of Towns." British Association, Exeter Meeting, Aug. 1869.

"Chemical Products from House Refuse and Sewage" (Stanford's Patent Carbon System). Chemical News, 1869.

"The Sewage Question." Sanitary Section, Glasgow Philosophical Society, 1870.

"Action of Charcoal on Organic Nitrogen." Jan. 1873. Journal of Chemical Society.

"On Algin." Chemical Society, 1883; Society of Chemical Industry, April 1884; Chemical Section, Glasgow Philosophical Society, April 1883.

"Exhibition of Stuffed Specimen of the Fulmar Petrel, and of the Oil vomited by the Bird." Chemical Section, Glasgow Philosophical Society.

"Commercial Analysis." Glasgow Philosophical Society.

"The Manufacture of Iodine." Chemical Section, British Association, 1876.

"Iodine in Cod-liver Oil." Nov. 1883. Journal of the Pharmaceutical Society.

"Does Cod-liver Oil contain Iodine?" British Pharmaceutical Conference, Sept. 1883.

"Alginic Acid and its Compounds." Society of Chemical Industry, April 1886.

"An Automatic Apparatus for making Infusions." Society of Chemical Industry, Feb. 1899.

"Thyroglandin." Belfast Meeting, British Pharmaceutical Conference, Aug. 9th, 1898.

"Alginoid Iron and some other Alginoids." Belfast Meeting of British Pharmaceutical Conference, Aug. 9th, 1898.

DAVID WATSON, D.Sc.

CHAIRMAN OF THE MANCHESTER SECTION OF THE SOCIETY OF CHEMICAL INDUSTRY, ETC.

It is with much regret that we announce the death of Dr. David Watson, Chairman of the Manchester Section of this Society, who passed away on Friday, December 15th, at his residence, Willow Bank House, Kersal Vale, Manchester, aged 53 years.

David Watson was the son of James Watson, an Edinburgh barrister. He was born July 27th, 1846, in Kensington. He received his education at the Old College of Chemistry in Oxford Street and the Royal School of Mines in Jermyn Street, taking his associateship in Metallurgy and Geology in 1867, in which year he was awarded the Edward Forbes medal. He subsequently took the degree of Doctor of Science of London University. Dr. Watson next became a teacher of chemistry at Chester College. Subsequently, after holding appointments at Sheffield (Cammell and Co.) and with Sir Lowthian Bell, F.R.S., at Washington, co. Durham, he proceeded to the Broughton Copper Works, Manchester, first as chemist and afterwards as manager—a post which he held until his death.

His services as Chairman of the Manchester Section were very highly esteemed, and he was beloved and respected by all who knew him.

SIR HENRY TATE, BART.

HENRY TATE, a son of the Rev. Wm. Tate, of Chorley, Lancashire, was born March 11th, 1819. From Chorley he went as a youth to Liverpool, where he served an apprenticeship in the grocery trade, and by the time he was twenty-two he was in business for himself and the owner of several shops. About this time he commenced sugar refining, and in the manufacture of his patent cube sugar he attained great wealth and became the head of the firm of Henry Tate and Sons. It was about 25 years ago that Henry Tate transferred his great business to London, and several years ago he retired from the firm of Henry Tate and Sons, of Mincing Lane and Liverpool, with works at Silvertown, employing upwards of 2,500 hands.

Sir Henry Tate not only took a great interest in art, but also in applied science and in education generally. He built the Brixton Free Library. He also had a heart that could be touched by the appeals of charity. Accordingly, he not only founded, built, and hung with pictures the great Tate Picture Gallery in Pimlico, the erection alone of which is said to have cost him 160,000*l.*, and presented 42,000*l.* to the newly founded University College, Liverpool, but he gave a still larger sum to various Liverpool hospitals. He was created a baronet in 1898.

It is a sad coincidence that the day on which the building of his Picture Gallery was completed he took to his bed with the illness which ended in his death.

He died at his house, Park Hill, Streatham Common, Tuesday the 5th inst.

Sir Henry Tate leaves several sons and daughters, and is succeeded in the baronetcy by Mr. William Henry Tate, who was born in 1842.

Journal and Patent* Literature.

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* Any of these specifications may be obtained by post by remitting 8*d.*—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Condensers and Evaporators [*Gas, &c.*]. S. Puplett, Westminster. Eng. Pat. 25,068, Nov. 28, 1898.

Condensers for gases, such as carbon dioxide, ammonia, and the like, and evaporators for liquefied gases, are constructed of a series of members, duplicates of each other, which are connected together by suitable unions, so that any member can be readily removed for cleansing, repair, or renewal without disturbing the others. The outlet of the condenser or evaporator is connected to an inclined gravitation chamber of larger diameter, through which the liquid or gas is caused to flow at a slower speed than through the other parts of the apparatus.—R. A.

Filter Presses, and similar Filtering Apparatus. J. Wilson, Glasgow. Eng. Pat. 26,931, Dec. 21, 1898.

The invention is a development of the patentee's prior patent, 18,074 of 1898 (this Journal, 1899, 737), which relates to filtering apparatus wherein the deposit is formed into cakes. The guide rollers, which carry the filtering cloth, are arranged two at the top and one at the bottom of each plate, and the nipping rollers, which draw the cloth through the apparatus, are made detachable, so that the cloth can be removed from the press. The cleansing brushes are mounted on a moveable bed-plate adapted to run on rails, so that they can be withdrawn from or brought into operative position, as required. A bogie or receptacle, adapted to receive the cakes discharged from the apparatus, is similarly mounted at a lower level, and is brought into position when the brushes are withdrawn. One set of brushes and one such receptacle may serve for a set of presses. The brushes are held in contact with the cloth by means of springs, and can be put out of action simultaneously by a hand lever. During the cleaning of the cloth, the plates and frames are held apart by knuckle-jointed distance pieces.—R. A.

Heating or Cooling Liquids, Air, or Gases, Apparatus for. W. Witkowitch, Kieff, Russia. Eng. Pat. 16,381, August 11, 1899.

The apparatus consists of a closed chamber, traversed by a series of tubes for the passage of the heating or cooling medium. The tubes are open at both ends and are arranged in alternately crossing rows. The apparatus is used by immersing it in the fluid to be treated.—R. A.

Refrigerating and Refrigerants. S. H. Emmens, Richmond, New York City, U.S.A. Eng. Pat. 19,085, Sept. 22, 1899.

The method of refrigeration described by the patentee consists in freezing substances that at ordinary temperatures remain liquid, within sealed cans or equivalent portable receptacles, and utilising these as refrigerants. The liquid may be water, saline solutions, alcohols, or a mixture of water and glycerin, or alcohol, or both, a mixture of equal parts of water and glycerin being preferred. The inventor names this liquid, "glycee." It freezes, he states, about 23 degrees below zero Fahr., and has a specific heat greater than that of ice. 1 lb. of this liquid superfrozen to 300 degrees below zero Fahr. is said to be capable, when acting as a refrigerant and rising to 42° F., of absorbing 358 thermal units. The liquid is frozen, or it may be cooled below the freezing-point, by means of the apparatus usually employed for liquefying gases. The receptacles containing the frozen liquid are enclosed in a non-conducting case of felt-lined wood, &c., which serves to protect the receptacles during transport. When required for ice-production, the case is formed with a recess to receive a tray containing the water to be frozen. For transport in large quantities, the receptacles are made flat-sided, and a number of them are enclosed in a single case. The liquid can be again frozen at a charging station after the cooling power has been exhausted.—R. A.

II.—FUEL, GAS, AND LIGHT.

Coal, Graphite, Carbons, &c., X-Ray Estimation of. H Couriot. Eng. and Mining J. 1899, **68**, [19], 547.

The author makes use of Röntgen rays for the determination of the purity of fuel. The apparatus employed consists of a Ruhmkorff coil giving a 12-in. spark, an independent interrupter being used with powerful coils. A reducer of potential allows the use, after transforming, of any current. Villard anticathode tubes are preferable for the coil; the rays furnished by a cathode in the form of a sphero-concave mirror are concentrated on the platinum or palladium plate which forms the anticathode. The pressure of the residual gas is so varied by absorption in caustic potash as to obtain in the tube a constant resistance to the passage of the current. Finally, a fluorescent screen is made by coating a piece of cardboard with powdered platino-cyanide of barium mixed in collodion with acetate of amyl.

The sensitive plate (preferably ortho-chromatic) is placed in a wooden frame with a sheet of lead on the glass side of the plate. The frame is closed and the specimens placed on this closed frame. The exposure in the case of a plate 8 in. from the source of the rays varies from 30 seconds to 5 minutes with a 16-in. spark, and for a piece of coal about $1\frac{1}{8}$ in. thick, about 15—30 seconds are required. For examination, the specimens are placed between the core and the fluorescent screen. For ordinary work or rough approximation, it is not necessary to cut regular blocks, as pieces from $\frac{3}{4}$—3 ins. thick are readily detached by the natural cleavage planes. It is better to work with pieces having a nearly constant thickness—say from $\frac{3}{4}$ in. to $1\frac{1}{8}$ in. The sample should be so arranged that any shale stratification may be in the plane of the rays, when they will appear with greater distinctness. It is stated that the process can be applied equally well to carbon anodes, carbons for arc lights and dynamo brushes, ozokerite, asphalt, and graphite.
—A. S.

Peat Fuel in Canada. J. Soc. Arts, 1899, **47**, [2449], 881.

The large bed of peat bog in the county of Perth, Ontario, eight miles north of Stratford, has now been worked for about a year. The swamp has an area of 40,000 acres with a depth of bog that varies from 1 ft. to 20 ft. The method of operating is as follows:—The peat is cut, and air-dried, then pulverised by being passed through a "pickler," and automatically deposited in a hopper, which feeds a steel tube about 2 ins. in diameter and 15 ins. long. The pulverised peat is forced through the tube by pressure, and formed into cylindrical blocks, 3 ins. in length, and almost equal in density to anthracite coal. As regards weight, 1 cb. ft. of peat weighs 83 lb.; of bituminous coal, 73 lb.; and of anthracite coal, 93 lb. Peat is stated to be superior to coal in that it is free from sulphur, and gives no appreciable smoke, soot, dust and clinker during combustion.

The Canadian company working this deposit believe that they will shortly be able to produce compressed peat fuel for about 2*s.* 6*d.* per ton.—A. S.

Crude Petroleum and its Products as Fuel. H. Tweddle. Eng. and Mining J. 1899, Oct. 14, 459—460; Oct. 21, 488—490; Oct. 28, 517—520.

THE author communicates a long article on the application of crude petroleum and its products as fuel. He sums up the chief practical advantages and conveniences of liquid fuel as follows: —

1. Diminished loss of heat owing to the clean condition the tubes can be kept in, and to the smaller amount of air which has to pass through the combustion chamber for a given consumption of fuel.
2. A more equal distribution of heat in the combustion chamber, as the doors do not have to be opened, and consequently a higher efficiency is obtained.
3. With oil there is no chance of getting dirty fires on a "hard run" as with coal.
4. A reduction in the cost of handling fuel, since in one case it is all done mechanically or by gravitation, whilst with solid fuel a great deal of manual labour is required.
5. No firing tools or grate bars are used, consequently the furnace lining and brickwork floors, &c. suffer less damage.
6. No dust or ashes to be handled or carted away.
7. Petroleum does not suffer while being stored, whilst, on the other hand, the deterioration of coal under atmospheric influence is well known.
8. Ease with which the fire can be regulated, from a low to a most intense heat in a short time.
9. Absence of sulphur and other impurities, and longer life of plates, &c.
10. Lessening of manual labour to fireman.
11. Great increase of steaming capacity. (See also "*Petroleum in the Manufacture of Sheet Iron*," page 1129.)
—A. S.

Naphthalene Stoppages, Removal of, by Means of Xylene. Breitkopf. J. für Gasbeleucht. 1899, 42, [40], 671.

THE author has made trials with xylene for the removal of naphthalene stoppages, as recommended by Bunte and his pupil Eitner (this Journal, 1899, 356 and 742). The stoppages occurred in the atmospheric condenser and in the main pipe leading from the former to the coke condenser or scrubber. In the pipe leading to the atmospheric condenser, a dripping arrangement was fixed, consisting of a siphon tube, formed of ½-in. gas-piping, the upper end of which was enlarged in the form of a funnel. Above the funnel was placed a zinc-plate tank with tight-fitting cover, and provided with an outlet tube and stopcock. The tank held enough xylene to last for 3—4 days, at the end of which time, it was refilled. Before the experiment, the condenser and the pipe were examined, and it was found that the deposit of naphthalene extended over one-eighth of the total cross section. In the course of about four weeks, observations were made, and it was found that the naphthalene had completely disappeared both from the condenser and the pipe.—A. S.

Naphthalene in Gas, Quantity of. W. Young. J. Gas Lighting, 1899, 74, [1898], 755—756.

THE author states that a table of the weights of naphthalene required to saturate a given volume of gas, compiled by R. W. Allen from experimental data, does not harmonise with the law that a gas which is brought in contact with a homogeneous volatile substance of fixed boiling point—such as naphthalene—is permeated by the vapour of that substance in constantly increasing increments per degree as the temperature rises. The value of Allen's figures is marred, he considers, by this want of harmony with the above law; but in any case they cannot be of much practical utility, because they apply to a dry permanent gas, whereas coal-gas contains the vapours of many other hydrocarbons, which partially replace the naphthalene which would be present if the gas were saturated only with naphthalene vapour. When high heats are employed in carbonising, however, condensable and volatile hydrocarbons are formed in small amount and naphthalene in large quantities; and under these conditions the gas leaves the manufacturing plant highly charged with naphthalene, and the quantity of condensable hydrocarbons is too small to prevent the naphthalene being deposited in the solid state. The condensable hydrocarbons will, however, amount to at least $1\frac{1}{2}$ lb. per 1,000 cb. ft. of gas, and gas thus charged will not, the author states, require much naphthalene vapour for its saturation therewith. For instance, J. P. Leather has found that Burnley coal-gas, not cooled below 70° F., contained 140 grains of naphthalene per 1,000 cb. ft., which is much lower than the quantity given by Allen for the saturation of a gas at about that temperature. Allen states that 270·9 grains of naphthalene would be required to saturate 1,000 cb. ft. of gas at 68° F. That the Burnley gas, containing only 140 grains, was saturated, was shown, however, by the fact that naphthalene was deposited from it during distribution.

The author considers that ordinary coal-gas contains about 100 grains of naphthalene per 1,000 cb. ft., and that 60 to 70 grains should be removed from it in order to preclude the risk of deposition during distribution. The removal of this amount of naphthalene would reduce the illuminating power of the gas by about 0·03 candle, which would be restored by the vapour of 110 grains of benzene, costing, at 9*d*. per gallon, about 0·016*d*. Therefore, if the gas were washed with creosote oil for the removal of the naphthalene, the illuminating power lost thereby could be readily and cheaply restored by the addition of an excess of benzene to the creosote oil. In some gasworks, larger quantities of naphthalene may occur in the gas, but in such cases the author says that the excess will be found to have been carried forward in the current of the gas in a state of fine mechanical division, and not in the state of vapour. No portion of such naphthalene would be worth retaining in the gas for its illuminating value, for its subsequent deposition might lead to great trouble and expense.—J. A. B.

Acetylene, Purification of. Imp. Inst. J., Dec. 1899, 321.

ATTENTION has repeatedly been called, by writers on acetylene and acetylene-lighting, to the necessity for purifying the gas generated by the action of water upon commercial calcium carbide.

The most important impurities in the gas so obtained are (1) ammonia; (2) sulphuretted hydrogen; (3) phosphoretted hydrogen.

The two former being very soluble in water, are avoided in those generators in which calcium carbide is allowed to fall into excess of water, and even if not completely removed in this way, their removal is a very easy matter by means of the well-known methods used in the purification of coal-gas. The removal of the phosphoretted hydrogen, however, is not such a simple matter, and it is a constituent which imparts a very offensive odour to the gas, and when the latter is burnt, phosphoric oxide is produced from the impurity, which has a most destructive action, and is irritating to the lungs.

Three methods are in common use for the removal of phosphine from acetylene, depending upon the possibility of oxidising the phosphorus compound without destroying the acetylene.

The earlier suggestion for the use of bleaching powder to purify acetylene is to be found in a patent taken out in 1896, but the method has really been worked out by Messrs. Lunge and Cedercreutz. (This Journal, 1897, 1046.)

The chlorine compounds introduced by the passage over bleaching powder may be removed by sending the gas over a layer of slaked lime.

It has been the custom with some firms to mix the bleaching powder with sawdust, in order to increase the absorbing surface, and it is probably this admixture which has led to the sudden heating of the purifier and consequent inflammation of the gas in some cases; it is therefore best to dilute the chloride of lime with an inert substance, such as sand or kieselguhr. When these precautions are observed, there is no danger whatever attending the use of a bleaching-powder purifier, and such an apparatus can be safely left in the care of a workman.

Acetylene, The Action of, on Copper. H. Alexander. Ber. **32**, [13], 2381—2384.

Acetylene, passed over pure precipitated copper in the cold, is without action. When the temperature is kept carefully at 240—250 C., however, the gas is absorbed, with formation of small quantities of a greenish liquid smelling like a petroleum hydrocarbon, and of a solid, light brown cork-like substance, which gradually fills and closes the after part of the tube.

No acetylene could be obtained from this substance, and no solvent could be found for it. Heated in the air, it gave off yellowish fumes with an odour of wood-tar, and then took fire, burning with a bright glow. It contains about 2 per cent. of copper, which, however, can be removed from it by solution in hydrochloric acid and ferric chloride without essentially altering its properties. The author is investigating the substance further, but meanwhile regards the copper as a contact substance, effecting the molecular condensation of the acetylene to this cork-like hydrocarbon, while any hydrogen evolved is not set free, but goes to the formation of the liquid petroleum-like substance above mentioned.—J. T. D.

Acetylene, Preparation of Ammoniacal Cuprous Solution for Detecting, by Means of Hydroxylamine. L. Ilosvay von N. Ilosva. Ber. **32**, [14], 2697.

See under XXIII., *page* 1158.

PATENTS.

Fire Lighters, Ingredients for, and the Manufacture therewith. H. Weisz, E. Abonyi, and C. Neuburg, Budapest, Hungary. Eng. Pat. 8260, April 19, 1899.

Wood shavings or the like are dried, steeped in a hot mixture of rosin, stearine, mineral oil, and turpentine, drained, and pressed into required shapes.—R. S.

Torches or Vapour Burners applicable for Lighting and Heating. J. Graham, Boston, U.S.A. Eng. Pat. 17,114, Aug. 23, 1899.

An oil tank is provided with an oil-supply pipe having a regulating cock, and with a number of holes in the top surface at which the vapour is ignited. The tank is attached to, and its lower part surrounded by, a cup having large and numerous openings. This cup is packed with asbestos, and oil is distributed on to the asbestos from a pipe having a regulating cock and a number of fine openings. A central air and vapour tube passes through both oil tank and cup, and is provided with perforations and openings, some to allow air to pass into it from the outside, others to allow vapour to pass from the absorbent material into it, and others to allow vapour or oil to pass either into it from the oil tank, or *vice versâ.* The oil absorbed by the asbestos is first lit, whereby vapour is generated within the oil tank. This vapour then becomes ignited, and continues to burn as long as fresh oil is supplied to the tank.—R. S.

Treating Fuel, New or Improved Method of and Apparatus for. G. C. Marks, London. From J. Hemingway, Spearfish, U.S.A. Eng. Pat. 17,969, Sept. 5, 1899.

1. "A method of coking fuel consists in confining the fuel within a chamber, heating a gas, forcing it under pressure into said oven above the fuel, causing the combustive combination of said gas with the gases emitted from the fuel in said chamber, and effecting the flow of the gases in the oven through an opening in the top thereof." 2. A "process of driving off volatile and fluid constituents of fuel consists in confining the fuel in a chamber, driving air through a furnace and then through a highly-heated medium, and then forcing the gases thus produced, under pressure, into a fuel chamber above the fuel." 3. A "process of coking and distilling fuel, characterised by the introduction of a current of gas into the coking oven, condensing the products of combustion, and separating the liquid from the gaseous products." A combination of apparatus for carrying out each of these methods is claimed.—R. S.

Burners for Pulverised or Liquid Fuel. G. S. Emerick, Philadelphia, U.S.A. Eng. Pat. 18,488, Sept. 13, 1899.

The claim, in a burner for pulverised or liquid fuel, is for the combination for heating furnaces or kilns, of a cylindrical chamber, through which passes a central tube connected to two pipes, one for supplying liquid fuel, the other for introducing fluid—steam or compressed air—to impart velocity to the fluid fuel during its passage through the central tube. An outer cone is adjustably secured to the cylindrical chamber, and an inner cone is arranged concentric with the outer one, both cones having their lips bent slightly inwards. A feed pipe for introducing pulverised fuel is connected to the chamber, and a smaller tube is attached to this pipe for introducing fluid under pressure to impart velocity to the pulverised fuel during its passage through the burner. The pulverised fuel receives a rotary motion by means of a helical flange arranged in the annular space between the inner tube and the walls of the cylindrical chamber.—R. S.

Coke Ovens, Impt. in. G. Hilgenstock, Dahlhausen, Germany. Eng. Pat. 19,757, Oct. 2, 1899.

Coke ovens are claimed, "wherein a direct communication is established between each coking chamber and the two contiguous ones by means of channels through which the gaseous products of distillation can pass directly from the one chamber to the other without being brought in contact with air or combustible gases."—R. S.

"Producer Gas" and Apparatus therefor. H. C. Jenkins and T. C. Lowden, London. Eng. Pat. 21,851, Oct. 17, 1898.

In connection with gas producers the inventors claim :—

The combination with the hot, generating chamber of an adjoining cooler chamber wherein the gases are cooled to prevent decomposition of the by-products.

The use of a steam- or water-spray to regulate the temperature of the apparatus; the spraying of liquid or steam on the casing of the producer, and then mixing the same with air and applying the mixture to fuel within the producer, for the formation of "producer gas" and by-products.

The employment in the cooling chamber of a tank containing perforated partitions for producing a tortuous circulation in the cooling liquid employed.

The use of a special form of panel supporting the fire-bars, and capable of removal and replacement without difficulty. —C. S.

Vapour-burning Apparatus. W. L. Wise, London. From A. Kitson, Philadelphia (Pa.), U.S.A. Eng. Pat. 22,204, Oct. 21, 1898.

Among the features referred to in the 37 claims put forward by the inventor, is a special form of vaporising tube containing an internal closed tube, so as to leave an annular space for the passage of the oil to be vaporised. In the one form of lamp described (a hanging lamp), the incandescence mantles and burners are enclosed in an air-tight globe, so that the only air admitted is that entering in admixture with the vapour, the vaporising tube discharging, through a ʌ-shaped aperture in the under side, into a mixing chamber to which air is admitted, and which leads to the pipe feeding the burners. A heat shield, enamelled on the inner side, is fixed above the mantles, and the discharge openings for the products of combustion, in the chimney, are covered with gauze arranged so that no scale, &c. can fall down on to the mantles. The feed-pipe communicates, below the burners, with an oil-pocket containing an absorbent material and fitted with a drip-cock. For starting the lamp, alcohol is ignited in shallow cups arranged below the burners so as to heat the feed-tube, or gas or electricity may be employed for the same purpose.

A form of portable lamp and a heating stove are also described, together with an electrical vaporiser. All joints above the level of the burners are rivetted or screwed, thus precluding the injury liable to accrue to soldered or brazed joints under the heat generated in the lamp.—C. S.

Carburetted Air, and Apparatus therefor, Process of Producing, H. Rey, Brussels. Eng. Pat. 26,533, Dec. 15, 1898.

THE carburetting liquid is vaporised by a current of air forced into the bath and distributed by a single perforated plate heated by a hot-water or steam coil, the vapours being then conducted into a perforated vessel, with an outer envelope acting as a surface heater, where the mixing process is continued. Finally, the carburetted air is passed through one or more purifiers containing hygroscopic material to absorb any moisture present in the air. The liquid in the bath is maintained at a constant level by means of a Mariotte pipe leading from the storage vessel. The air-pump is provided with a diaphragm-chamber and escape-valve, in order to regulate the air-pressure in accordance with the fluctuations in the consumption of the gaseous product.—C. S.

Gas Washer, A New or Improved. J. E. Dowson, London. Eng. Pat. 25,866, Dec. 7, 1898.

THE washing vessel is fitted with a perforated horizontal diaphragm, which is suspended therein in such a manner as to prevent the supernatant layer of water escaping round the edges, and is so placed that the gas to be washed has to pass through small holes in the diaphragm "of such size that water above the diaphragm is upheld by the currents of gas passing through the perforations of the diaphragm, while at the same time there is an intimate mixture of the gas and water." Means are provided for the admission of water above the diaphragm, "there being an overflow at such height as to maintain the depth of water required on the said diaphragm."—C. S.

Gases [Illuminating Gas], Compressing of. W. T. Sugg, Westminster. Eng. Pat. 26,697, Dec. 17, 1898.

THE gas is compressed by a pump worked by a direct-acting water-motor, the inlet and outlet passages of the pump opening, through valve-controlled passages in the walls of the cylinder, on both sides of the piston, so that the piston is operative in both directions of its travel. To regulate the pressure of the gas to the installation, the compressed gas from the pump is passed through a governor mechanism, which controls a slide-valve or other cut-off in the water supply to the motor, so that the working of the motor will be dependent on the number of lights burning, an excessive pressure also acting to close the inlet valve from the pump.—R. A.

Gas Burners, Self-lighting. F. Zacher, Hamburg. Eng. Pat. 15,760, Aug. 1, 1899.

THE igniting plug on the body in the burner is controlled by a spring and kept in the position for ignition by means of a locking lever, which is connected with an expansive body heated by an auxiliary flame when the main burner is lighted, the expansion causing a movement of the locking lever, in consequence of which the lever of the igniting plug is released and the latter is drawn away from the burner by the controlling spring. When the flame is extinguished, the contraction of the expansive body pulls the locking lever back and thus restores the igniting plug to its initial position.—C. S.

Bunsen Burners for Gas Stoves. F. W. Golby, London. From F. Houben, Aachen, Germany. Eng. Pat. 16,706, Aug. 17, 1899.

IN order to diminish the length of the mixing tube in stoves consuming a large quantity of gas, the axes of the gas-jet nozzles are "inclined towards the axis of the gas burner so that the conical gas jets issuing from these nozzles at an acute angle, strike the interior of the mixing tube, and from there glance off at a corresponding angle," thus ensuring more intimate mixture of the gas and air. The mixing tube consists of a combination of right and inverted cones, or of a cone and cylinder and a plate is provided to separate the space around the air inlet from that around the mixing tube, to prevent the gas from gaining access to the latter space.—C. S.

Gas, Method of Purifying. B. E. Chollar, St. Louis, U.S.A. Eng. Pat. 17,888, Sept. 5, 1899.

THE inventor claims a system of purifying gas and regenerating the purifying material (ferrous oxide) by passing the gas, mixed with oxygen, air, or ozone, through the said material in one direction, and then, when the portion coming first into contact with the gas is spent, reversing the direction of flow of the incoming gas, so that the other portion of the material comes into action, the spent portion being meanwhile regenerated by the oxygen, &c. present in the gas.—C. S.

Incandescence Gas Burners. L. Jacquinet, Brussels. Eng. Pat. 24,007, Nov. 14, 1898.

THERE is claimed an incandescence gas burner "on the Giffard principle," comprising a conical chamber, which surmounts the gas-inlet nozzle and at the base of which the air enters, and a tubular extension, carrying a conical cup, downwards into which a cone projects, forming an annular orifice with the upper edge of the cup. The inverted cone is surmounted, base to base, by another cone, for elongating the flame which burns at the annular orifice. The burner is surmounted by a mantle as usual.—H. B.

Mantles for Incandescent Gas Lighting. F. M. and M. L. Missire, Paris. Eng. Pat. 26,221, Dec. 12, 1898.

THREADS made of precious metals are coated with salts of the rare earths "by means of a solution, or in any other suitable way." The salts are then reduced to oxides by means of a Bunsen flame or by means of an electric current, and the coated threads are arranged in any suitable shape over a Bunsen flame.—H. B.

Incandescence Lamps for Burning Oils, Alcohol, and other Volatile Fluids, also Solid Fats and Resinous Substances. L. Denayrouze, Neuilly-sur-Seine. Eng. Pat. 26,474, Dec. 14, 1898.

THE lamp is wickless, the combustible liquid being supplied to the vaporiser under pressure. In the base of the lamp are situated accordion-shaped bellows, which are filled with air by means of a caoutchouc inflator. A coiled spring acting on the top of the bellows forces the air under pressure into the fuel container, from which, in the case of of alcohol, the liquid rises into an upright pipe, being vaporised within a coiled portion of the pipe situated above the mantle. The vapours then pass down a continuation of the pipe to the base of the burner, where they mix with air and burn in a Bunsen burner as usual. A screw-valve regulates the supply of liquid from the container.

When the vapours require also to be gasified, the tube descending from the vaporising spiral is connected to a platinum tube of small diameter, which forms a bridge over the mouth of the burner, the gas being then led down to the base of the burner as before.

When fatty bodies are to be used, a cup-shaped protuberance is provided at the base of the reservoir to serve as a melting vessel, to which heat is conducted from the burner by a metallic rod.

The lamp and combinations of parts are claimed.—H. B.

Mantles for Incandescent Lighting. H. Kayser, Berlin. Eng. Pat. 26,856, Dec. 20, 1898.

THERE is claimed an incandescent mantle for low-pressure burners, in which the fabric is composed of vertical meshes of various sizes, the upper end being provided with abnormally large meshes.—H. B.

Incandescence Gas Burners with Automatic Ignition Devices therefor. H. Burkert, Berlin. Eng. Pat. 16,212, Aug. 9, 1899.

THE patentee considers the failure of the present automatic ignition devices to be due to an insufficient supply of oxygen. In the burner claimed, the burner-head is provided with upwardly-inclined air-supply passages, meeting in a central chamber at the top, above which is suspended an automatic ignition device, such as an ignition ball with depending platinum wires.—H. B.

Carbon Specially Suitable for Use in the Manufacture of Calcium Carbide. F. Schmidt, Cassel, Germany. Eng. Pat. 18,263, Sept. 9, 1899.

The following is the substance of the claims:—"1. The production of a carbon specially suitable for use in calcium carbide manufacture, in which carbon-containing or carburetted gases or vapours are passed through raw carbon, such as coke, charcoal, peat charcoal, and the like, previously raised to a glowing heat in suitable retorts, whereby the carbon is converted into a graphite-like material. 2. The modification in which, instead of introducing carburetted gases into the retort, substances are introduced which generate such gases or vapours. 3. Treating the raw carbon in the presence of the amount of lime required for producing calcium carbide."—R. S.

Acetylene Gas, Means for Generating, Purifying, Storing, and Distributing. A. D. Williamson, Coleraine, Ireland. Eng. Pat. 22,272, Oct. 22, 1898.

The generator consists of a bell gasholder, in the tank of which a tap is placed at a given level. In the crown of the bell is an annular seal in which the outer wall of a double-walled bell is sealed. The interior of this inner bell is divided into compartments by two diaphragms. The upper compartment receives water, which weights the bell and determines the pressure at which the gas is generated, while the lower compartment is merely an air-tight chamber. To the base of the inner bell is attached a cage containing carbide. The annular seal dips into the water in the gasholder tank when the tap in the latter is open, and the water reaches to the level of the tap. The inner bell may thus be withdrawn for recharging the cage with carbide, and the gas contained in the bell will not escape. The gas, which is generated whenever the bell descends so far as to bring the cage in contact with the water, passes through a condenser and a purifier containing oil, chlorinated lime and oxide of iron to a counterpoised distributing gasholder.—J. A. B.

Acetylene, Process and Apparatus for Purifying. G. Dollner, Rixdorf, near Berlin. Eng. Pat. 22,330, Oct. 24, 1898.

The purifying agent is an acid solution of any metallic salt which in an alkaline condition has a special affinity for acetylene, or of a salt which forms several series of compounds. The agent may be absorbed by kieselguhr or other porous substance. As examples of suitable mixtures, are given:—(1) Ferric chloride dissolved in dilute hydrochloric acid. (2) A mixture of anhydrous sodium sulphate, cupric chloride, and so much hot dilute acid as will furnish the water of crystallisation of the sodium sulphate, so that, on cooling, the mixture solidifies. (3) Mercuric chloride or sulphate dissolved in fused acid sodium sulphate. (4) A solution of chromium chloride in melted chromic acid or oxalic acid.

The purifying agent is contained in an acid-proof vessel, with perforations at the bottom, and a flange at top which forms an air-tight joint with an internal flange in a metal shell, to the lower part of which the gas is admitted. The gas passes, by means of the perforations, through the purifying receptacle, and thence to an exit pipe in the upper part of the shell, which is closed by an air-tight cap. An acid-proof pan receives any liquid which drops from the perforations.—J. A. B.

Acetylene Gas, Generators for. H. de Thiersant and W. A. Coulson, both of London. Eng. Pat. 23,675, Nov. 10, 1898.

A vessel containing water is provided with a screw cap, to which is attached a cylinder, which reaches nearly to the bottom of the vessel. Within the cylinder fits tightly a cylindrical vessel containing a cage of carbide. This inner vessel is provided with a spiral groove, in which are perforations, and the water in the outer vessel gains access to the carbide through these perforations. The gas passes away by an exit pipe in the screw cap. The generator is intended for use on vehicles.—J. A. B.

[Acetylene] Gas Generators. F. W. Lanchester, Birmingham. Eng. Pat. 24,771, Nov. 23, 1898.

The upper part of a vessel, in which is a tray of carbide, communicates by a pipe with the upper part of a vessel containing spongy material, which is kept saturated by water in the bottom of the vessel. A pipe leads from this vessel to a fan, and thence to the lower part of the vessel in which is the carbide. The fan draws gas saturated with aqueous vapour from the spongy material, and forces it through the tray of carbide, with which the aqueous vapour reacts and forms acetylene. The dry gas passes on to the saturator, and is again saturated with aqueous vapour, which decomposes more carbide. The surplus acetylene is led away by an exit in the upper pipe. Other means of maintaining the circulation may be used in place of a fan, and the method may be employed to produce any gas which is formed when a vapour is brought in contact with a solid.—J. A. B.

Acetylene Gas Generators. D. Thubron, Scarborough. Eng. Pat. 25,227, Nov. 30, 1898.

The bell of a gasholder placed above a retort containing carbide comes in contact, when it descends to a certain point, with the end of a lever, and thereby opens a valve which admits water from the gasholder tank to the carbide. The gas generated raises the bell, and the valve closes automatically. The gas passes from the gasholder through saw-cuts in a pipe, which leads downwards to a trap, where moisture may be deposited. Several modifications of the apparatus, suitable for use with buoys, portable lamps, &c., are described.—J. A. B.

Acetylene Gas, Apparatus for Generating. L. Steiner, Bucharest, Roumania. Eng. Pat. 10,151, May 13, 1899.

A number of carbide receptacles are supported from the crown of the bell of a gasholder, and have perforations at different levels, so that the water in the gasholder tank flows into one or more of the receptacles according to the position of the bell, and more or less gas is generated accordingly. The object of the arrangement is to generate gas at the rate at which consumption takes place.
—J. A. B.

Gas having Acetylene as a Base, Generation of, and Apparatus therefor. C. B. Richard and F. Cahen, both of Paris. Eng. Pat. 17,631, Aug. 31, 1899.

Carbide of calcium is contained in cartridges composed of zinc and copper sleeves, and is decomposed by water acidulated with hydrochloric acid. The water is stated to be decomposed by electric action into hydrogen and oxygen, the former of which mixes with the acetylene formed from the carbide, while the latter unites with the calcium resulting from the decomposition of the carbide. Compressed air is admitted to the generator, and its oxygen is said to be "taken up by the carbon of the carbide to form carbonic acid, which becomes mixed with the gas, while the nitrogen of the air is combined in a certain proportion with the hydrogen evolved from the water." The presence of inert gases with the acetylene, it is claimed, render it inexplosive, inodorous, and capable of burning with a smokeless but hotter flame.—J. A. B.

Acetylene Gas, Device for Generating. C. Dewey and J. A. Chown, both of London. Eng. Pat. 18,189, Sept. 8, 1899.

The burner and wick are removed from an oil lamp, and the oil reservoir is filled with water. A tapered vessel, closed at the broad upper end by a plate in which is an orifice, at which the generated gas is intended to burn, has a cap, through which a wick passes, inserted in its small lower end. The vessel is filled with carbide, and placed in the reservoir of the lamp, whereupon water passes through the wick to the carbide and generates gas.—J. A. B.

Acetylene Gas Burners for Cooking Stoves. F. Trendel, Berlin. Eng. Pat. 18,204, Sept. 8, 1899.

The gas nozzle is at the foot of a narrow mixing pipe, in which the gas and air mix. This pipe passes up into a larger mixing pipe, which extends some distance above the outlet of the narrow pipe, and carries the burner proper. Between the two pipes is a hollow space, which is said to cause the combustion to take place continuously with a non-luminous flame, even when the burner is fully heated and the pressure moderate.—J. A. B.

Acetylene Gas, Apparatus for Generating. A. E. Adolfsson, Stockholm. Eng. Pat. 19,345, Sept. 26, 1899.

In generators in which carbide is fed intermittently into water, a chamber partially filled with water is attached to the generator. Into the water in this chamber dip the ends of two pipes communicating with the air, and the end of a pipe which bends first downwards and then upwards through the tank to the gas space in a gasholder. A pipe, the end of which is bent over and dips in the water in the gas-holder tank, leads to the gas space in the generator. Water may be drawn off from the generator through a tap at its base, and gas passes in from the gasholder, through the pipe which is sealed in the water chamber, to take the place of the water withdrawn. Water is admitted to the generator through one of the open pipes which dip into the water chamber, and the gas thereby expelled from the generator passes to the gasholder through the tube which is sealed in the water in the tank of the latter. Water may thus be withdrawn from or added to the generator without risk of air gaining access to the interior.—J. A. B.

Conducting Connection between Electrical Incandescence Bodies of Second Class Conductors with Conductors of the First Class, Process for forming a. Siemens Brothers and Co., London. From Siemens and Halske, Berlin, Germany. Eng. Pat. 18,489, Sept. 13, 1899.

For making good connection between conductors of the first class and electrical glow lamps the incandescence body of which is formed of conductors of the second class, the ends of the latter, when coated with a suitable substance, such as metalloids, metal, or their oxygen-freed compounds, are heated to a white heat in an oxyhydrogen flame or other source of heat, so as to render them plastic, when, by pressing a first-class conductor into them, a rigid conducting connection is formed between the two on cooling.
—G. H. R.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

Peat, Utilisation of [Destructive Distillation]. G. Thenius. Oesterr. Chem. u. Techn. Zeit. 17, [20, 21, 22].

The main bulk of moorland peat is suitable for distilling, for which purpose it is preferably compressed in a Schlickeysen apparatus, which cuts the crude peat into a fine plastic mass, the stones and rootlets in it being removed by a sieve. The peat is then air-dried, preferably under sheds, and finally freed from moisture by heating in a kiln. One hundred parts of such compressed peat will yield, on dry distillation, 35—40 per cent. of good dense charcoal, superior to wood charcoal, 25 per cent. of ammonia water, 6 per cent. of tar, and 29 per cent. of gas. The tar furnishes on distillation 25 per cent. of crude burning oil, 20 per cent. of "solar" oil, 15 per cent. of lubricating oil, 25 per cent. of "paraffin" oil, and 15 per cent. of pitch. When freed from creosote by treatment with caustic soda, the burning oil gives a better light than petroleum; and the "solar" oil burns very well in a special lamp constructed by the author. A very fine white paraffin, harder than that from lignite tar, is recovered from the final distillates of peat tar by crystallisation and repeated re-meltings, pressings, &c. the colour being improved by treatment with 10 per cent. of 10 per cent. caustic soda, followed by 5 per cent. of sulphuric acid, and finally boiling with 5 per cent. of 10 per cent. caustic soda. After treating the cakes with 10 per cent. of petroleum spirit and subjecting them to high pressure, they are heated in a current of steam to render them inodorous, filtered through linen, and left to crystallise. The refined product is said to form excellent candle material.

The ammonia water contains methyl alcohol, ammonia, acetic acid, creosote, pyridine, and other organic bases. The acetic acid is recovered by treatment with milk of lime and distillation, the residue being then filtered to keep back the tarry bodies and evaporated to dryness; the crude calcium acetate can then be refined and converted into acetic acid. The methyl alcohol in the distillate is separated from the accompanying ammonia by adding sulphuric acid and redistilling, ammonium sulphate being left in the residue.

The peat gas (29—30 per cent.) may be either utilised as fuel or for lighting purposes. In the latter event it must be freed from the comparatively large percentage of carbon dioxide and tarry matter, by passing it through fresh milk of lime. The illuminating power is superior to that of gas from wood or coal; this gas has been profitably manufactured at Salzburg for some years.

The upper layers of peat are more spongy and lighter in colour than the rest, and are utilised for the production of peat-moss litter, millboard, packing paper, and alcohol, by fermentation and distillation. The fine siftings are suitable for use as an absorbent for sewage. The product (*poudrette*) is employed as a fertiliser in conjunction with treated bone meal, wood ashes, blood meal, ammonium sulphate, &c.

For paper making the peat fibres are decolorised by treatment with caustic soda, washing with water, and pressing, the product being ground and converted into pulp. The lighter peat also makes a good insulating material for inside walls, and is used for this purpose in the Tyrol and Switzerland.—C. S.

Petroleum (Crude), Distillation and Treatment of. V. I. Ragosin. Chem. Rev. Fett- u. Harz-Ind. 6, [7], 128—134; [8], 147—151; [9], 161—166.

In seeking an explanation of the differences in the character of various crude petroleums, the author favours the animal theory of origin, and looks upon them as secondary products formed from a primary oil under the influence of various local conditions. Baku oil he regards as of the primary type, on account of its content of true lubricating oils, whilst those of Binagady, Kuban, Grosny, and Imeritin are modifications due to evaporation and oxidation, facilitated by proximity to the surface and by the permeability of the strata; and the other varieties of crude oil have been modified by a kind of "cracking" process effected at moderate heat. Thus, assuming a primary deposit of oil and gas, subjected to heat, the expansion of the gas would be capable of expelling the oil through fissures in the rock and into a second storage place at any distance from the first; and if the heat were sufficiently prolonged, the gases themselves would follow, to some extent, and produce distillation, and even "cracking" of the oil, which might thus eventually become a mixture of primary and secondary oil in various proportions, depending on the temperature, duration of heating, &c. The light crude oil of Sumatra, containing 80 per cent. of petroleum spirit and burning oil, with 20 per cent. of distillate (sp. gr. 0·880) containing about 14 per cent. of pitch, is regarded as an oil in which the above action has been prolonged to completion. Again, the lubricating oil fractions of American crude oil are contaminated by inseparable decomposition products of equal boiling point—a circumstance affording evidence of similar modification, which, in the case of Galician oil, has apparently been arrested at an earlier stage, the percentage of lighter oils being lower and that of ozokerite greater.

It was upon the basis of these considerations that the author devised his distilling apparatus, employing petroleum spirit in place of steam (this Journal, 1899, 359 and 483), by means of which the progress of cracking Russian crude oil can be regulated so as to produce at will any of a large number of distillates and residual products, including paraffin and ozokerite.—C. S.

Petroleum Spirit ("Benzine"), Purification of. A. Gawalowski. Oesterr. Chem. u. Techn. Zeit. 17, [22], 9.

Petroleum spirit of bad odour is treated with 1—2 per cent. (by weight) of free fatty acid, which enters into solution. About $\frac{1}{4}$ per cent. of tannin is then incorporated by mixing, and is followed by sufficient caustic alkali or milk of lime to neutralise the fatty acid and the tannic acid. After shaking up and leaving to subside, the liquid separates into a soapy residue and a supernatant layer of petroleum spirit, sufficiently deodorised and decolorised for many technical purposes. Subsequent distillation furnishes a perfectly pure product. Any fatty acids—*e.g.*, those from lard, olive oil, &c.—may be used, provided they are free from rancidity; and candle-makers' "olein" is also suitable, if previously freed from malodorous liquid fatty acids (butyric acid in particular) by agitation with weak caustic alkali.—C. S.

Petroleum Lubricants, Solid. Petroleum Indust. and Tech. Rev., Nov. 25, 1899, 643.

The use of solid lubricants for machinery in the place of liquid lubricants is gaining ground every day. The principal methods for preparing the greases in question are stated to be as follows:—

1. Aqueous solutions of ordinary potash or soda soap are precipitated with a salt of lime, magnesia, or alumina. The precipitated soap containing the heavy metal is washed, dried, and dissolved in hot petroleum.

2. The lime soap is prepared in petroleum by emulsifying an aqueous solution of ordinary soap with the latter, and then decomposing with calcium chloride solution. The lime salt is stirred in at the boil, and the soda soap is gradually changed into a lime soap, and this dissolves in the petroleum as fast as it is formed. After some standing, the mother-liquid, which contains chloride of sodium and the excess of chloride of calcium, is drawn off. Fresh water is added, and the soap is once more boiled up. After another period of standing, the wash water is drawn off and the soap is stirred till cold.

3. A neutral fat is saponified with milk of lime, and the resulting lime soap is dissolved in petroleum.

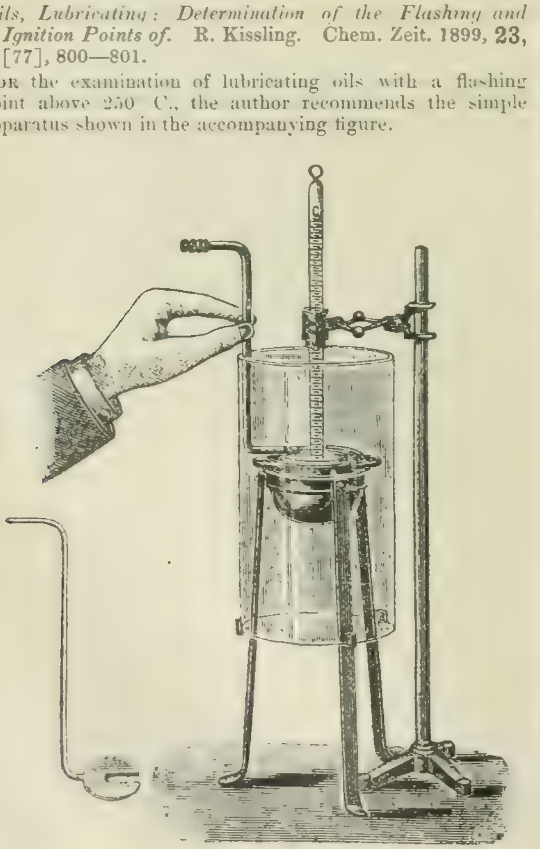
4. The lime soap is prepared in the presence of the petroleum by melting the latter and a fat together and then adding milk of lime for saponification.

The last two processes are the commonest in practice.

All possible varieties of petroleum, from the heaviest Russian oil down to rock spirit having a specific gravity of 0·875, are used, according to the viscosity that it is desired to impart to the product.

Oils, Lubricating: Determination of the Flashing and Ignition Points of. R. Kissling. Chem. Zeit. 1899, **23**, [77], 800—801.

For the examination of lubricating oils with a flashing point above 250° C., the author recommends the simple apparatus shown in the accompanying figure.



It consists of a tripod with attachments on its legs, on which rests a fireproof glass cylinder 250 mm. long and 100 mm. in diameter. A copper bath is supported on the top of the tripod, and this is filled with sand in which is embedded a porcelain crucible 45 mm. deep and 40 mm. in diameter at the top. The oil to be tested is placed in the crucible, which it fills to within 10 mm., and the crucible is so arranged that the surface of the oil and of the sand lie in the same plane. The flashing and ignition points are then determined by means of an ignition jet, which is introduced at regular intervals as soon as the oil reaches a temperature of from 20° to 30° C. below the flashing point. The flame heating the sand bath is so regulated that the temperature rises about 2° C. in 30 seconds, and this interval is left between the successive tests. The apparatus is also provided with a copper extinguisher, shown in the figure.—C. A. M.

Crude Petroleum and its Products as Fuel. H. Tweddle. Eng. and Mining J. 1899, Oct. 14, 459; Oct. 21, 488; Oct. 28, 517.

See under II., *page* 1109.

Ammonia Waters, Estimation of Carbonic Acid in. Chevalet. Chem. Zeit. Rep. 1899, [33], 322. From Ann. Chim. anal. appliq. 1899, **4**, 295.

See under XXIII., *page* 1156.

Coal Distillation, Recovery of Nitrogen in. W. Carrick Anderson and Jas. Roberts.

See page 1099.

IV.—COLOURING MATTERS AND DYESTUFFS.

Diphenylamine Sulphonic Acids and other Derivatives. R. Gnehm and H. Werdenberg. Zeits. für angew. Chem. 1899, [43], 1027—1030; also [44], 1051—1055.

In attempting to obtain a monosulphonic acid of diphenylamine by the action of ordinary sulphuric acid monohydrate or anhydride, the chief product was always found to be disulphonic acid. The desired product was, however, obtained by sulphonating acetyldiphenylamine and subsequent hydrolysis. A porcelain beaker containing 200 grms. of fuming sulphuric acid (20 per cent. SO_3) cooled to 5° C., has gradually added to it 100 grms. of finely powdered and well-dried acetyldiphenylamine. The melt is stirred continuously for two hours at 45° C., and is then poured into 250 c.c. of water. In order to hydrolyse the product, the whole is boiled for three hours, renewing the water, and is then poured into a large excess of water, cooled, filtered, and neutralised with barium carbonate. The barium acetate is easily removed by fractional crystallisation. A yield of 80 per cent. is obtained, whilst 17 per cent. of diphenylamine is recovered, and can be employed in subsequent operations. The barium salt is very slightly soluble in cold water, more so in hot, and crystallises in white anhydrous plates. The copper and sodium salts are obtained by double decomposition. In order to further characterise the acid, three molecular proportions of it were treated in acid aqueous solution with one molecular proportion of formaldehyde. The dark solution, on treatment with hydrochloric acid, gave, on standing, a precipitate of triphenyltriamidotriphenylmethanetrisulphonic acid. This acid turns pale blue in the air, and is soluble in water and alcohol, but oxidises very quickly in solution.

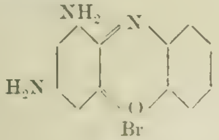
The free diphenylamine sulphonic acid itself is obtained by decomposing the well-crystallised copper salt with sulphuretted hydrogen. Its sodium salt combines with diazo solutions, yielding acid dyestuffs. For example, *p*-diazobenzene sulphonic acid on combination, yields a dyestuff crystallising in violet plates giving orange-yellow shades on wool and silk from an acid bath. Diazotised picramic acid also yields a dyestuff crystallising in shining brown plates. It was also observed that picramic acid itself combines with diphenylamine sulphonic acid in the proportion of 1 to 2 mols.

On nitrating acetyldiphenylamine, the authors obtained the acetyl derivative of di-*p*-dinitrodiphenylamine melting at 164° C., giving on hydrolysis *p*-dinitrodiphenylamine melting at 214° C., which on reduction yields di-*p*-diamidodiphenylamine melting at 155° C. When acetyl diphenylamine sulphonic acid is nitrated, it appears to form two isomeric nitro compounds. This assumption is based upon the separation of two products melting at 133° C. and 73° C. (the melting points of *p*- and *o*-nitrodiphenylamine) after splitting off the acetyl and sulphonic acid groups. If the barium salt of diphenylamine sulphonic acid be nitrated, a nitro compound is formed, of which the barium salt only could be isolated.

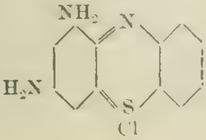
Diphenylamine can be converted into a disulphonic acid by the action of sulphuric acid monohydrate at 130°—140° C. for three hours, or of fuming sulphuric acid (25 per cent. SO_3) for the same time at 110°—120° C. The yields of barium salt are 115 and 170 grms. respectively, the corresponding insoluble residues amounting to 20 and 10 grms. The barium salt can be obtained in small needles containing $2H_2O$. On nitrating the well-dried salt in presence of sulphuric acid, an orange-red barium salt is obtained, which, on reduction with ferrous sulphate and barium hydrate, gives the barium salt of an amido acid. This separates as a reddish crystalline mass, very easily soluble in water and insoluble in alcohol.—T. A. L.

Oxazine Dyestuffs, and Tetravalent Oxygen, Constitution of. F. Kehrmann. Ber. **32**, [14], 2601—2611.

The physical and chemical properties of the oxazine and thiazine dyestuffs show such a similarity to those of the azonium compounds that they probably possess an analogous constitution. This necessitates the assumption that oxygen and sulphur in these compounds are tetravalent. The author has already proposed such a formula for Methylene Blue (this Journal, 1897, 973), but hesitated to do so in the case of oxazines until the publication of a paper by Collie and Tickle (J. Chem. Soc. 1899, 710), in which these investigators show that dimethylpyrone gives crystalline compounds with different acids in exactly the same way that dimethylpyridone does. They assume the presence of a tetravalent oxygen corresponding to the ammonium nitrogen, and term it "oxonium." Hence the azoxonium oxygen of the oxazine dyestuffs bears the same relation to the oxonium oxygen that the azonium does to the ammonium nitrogen. Several of these salts have been prepared. The condensation product of picryl chloride and *o*-amidophenol (dinitrophenoxazine) yields on reduction diamidophenoxazine, and this on oxidation forms salts of diamidophenazoxonium. The bromide, $C_{12}H_{10}N_3OBr$, is soluble in water without hydrolysis, and is not decomposed by sodium acetate or ammonium carbonate, sodium carbonate or hydrate being necessary to liberate the base. The substance shows the properties of the thionine and azonium dyestuffs, and contains a strongly basic group. That this basicity is not due to the amido groups is proved by the fact that, even after acetylation of both, the bromide is still soluble in water without hydrolysis. The substance therefore has the formula—



It crystallises from its greenish-brown solution in black plates, and has a bitter taste. In a similar manner the corresponding diamidophenazthionium chloride is obtained from dinitrophenthiazine, formed by condensing picryl chloride with *o*-amidothiophenol and heating the picryl amidothiophenol with alcohol and soda-lye. The product finally obtained, is isomeric with Lauth's Violet, and has the formula—



It separates from water in dark, reddish-brown crystals, which appear dark green by reflected light, the aqueous solution being olive-green. On mixing the tin chloride double salt with fused sodium acetate, and boiling with acetic anhydride, the product yields a diacetyl compound crystallising in greenish-yellow needles. The alcoholic solution of this compound, on treatment with ferric chloride, gives a precipitate of an oxidation product, details of which will be published later. In order to compare the two foregoing representatives of the oxazine and thiazine groups with a similarly constituted azonium compound, the author has reduced dinitrophenyldihydrophenazine, obtained from picryl chloride and phenyl-*o*-phenylene diamine (Ber. **26**, 2375). After oxidation, the pure dyestuff crystallises in greenish-black, steely needles, soluble in water and alcohol with a bluish-green colour. The diacid chloride shows the colour of the aposafranine salts, from which it follows that the amido group ortho to the azine nitrogen, in addition to the azonium group, is a salt-former, since the group characteristic of aposafranine is still free. Hence an amido group ortho to the azine nitrogen gives rise to a green colour, not only in the isosafranine described, but also in the isothionine and the corresponding oxonium compound. A spectroscopic examination of alcoholic solutions of the three green dyestuffs described also showed a similarity in regard to their absorption spectra, the most refrangible rays in all three being totally absorbed. It is, however, noteworthy that the analogy between the oxygen and sulphur compounds is closer than between these and the azonium compound, which exhibits also an absorption in the yellow. The spectroscopic results on the whole, and the chemical properties of all three compounds, confirm the view that they have an analogous constitution.—T. A. L.

Chloranisidines and m-Chloranisol. F. Reverdin and F. Eckhard. Ber. **32**, [14], 2622—2627.

According to an already published statement (J. prakt. Chem. **60**, 218), the halogen atom in *p*-brom- and *p*-chloranisol does not change its position on nitrating under certain conditions. Subsequent investigation (Ber. **32**, 152; this Journal, 1899, 263) has shown that with *p*-bromanisol this is not the case, and the authors have in the present paper repeated the work on *p*-chloranisol, and at the same time have also characterised the chloranisidines obtained by reducing the nitro-*o*- and *p*-chloranisols. On nitrating *o*-chloranisol with nitric acid (sp. gr. 1·4), the product formed is *o*-chloro-*p*-nitranisol—

$$1.2.4.C_6H_3.OCH_3.Cl.NO_2,$$

white needles melting at 95° C. It yields on reduction the corresponding amido compound, which is not volatile with steam, and dissolves readily in alcohol, ether, and benzene. It crystallises in white needles melting at 62° C. The acetyl compound melts at 94° C. and the picrate at 186° C. When *p*-chloranisol is nitrated the chief product is *p*-chloronitranisol, which melts at 98° C. and is volatile with steam, the other product being dinitro-*p*-chlorophenol—

$$1.4.2.6.C_6H_2.OH.Cl.(NO_3)_2,$$

and, with the exception of a small quantity of unaltered *p*-chloranisol, nothing else was formed. Hence the chlorine atom remains in the para position on nitrating *p*-chloranisol. On reducing the nitro compound, *p*-chlor-*o*-anisidine $1.4.2.C_6H_3.OCH_3.Cl.NH_2$ is formed, which crystallises in white needles melting at 82° C. and is volatile with steam. The acetyl derivative melts at 104° C. and the picrate at 194° C. If the amido group be replaced by hydrogen a chloranisol is obtained, which, on nitration, again yields the same nitro product as above, melting at 98° C. On the other hand, if the amido group be replaced by chlorine, a dichloranisol is obtained melting at 27° C. and having the constitution $1.2.4.C_6H_3.OCH_3.Cl_2$. Herold (Ber. **15**, 1684) assumes that a base (melting point 52° C.) he obtained as a by-product in the preparation of *o*-anisidine has the constitution assigned to the above base melting at 98° C. The authors, however, show that this base is a derivative of *m*-chloranisol, and has the constitution $1.2.5.C_6H_3.OCH_3.NH_2.Cl$. Its acetyl compound melts at 149° C., and, after eliminating the amido group, *m*-chloranisol is obtained, which on nitration gives a nitro compound melting at 58° C. To complete the series, the authors have also prepared *o*-chloro-*m*-anisidine—

$$1.2.5.C_6H_3.OCH_3.Cl.NH_2$$

by replacing in *m*-nitro-*o*-anisidine melting at 140° C. the amido group by chlorine and reducing the product obtained. The base melts at 77° C., and gives an acetyl compound melting at 122° C. The colours obtained from all these diazotised bases and β-naphthol show similar differences to those observed in the case of phenetidine (this Journal, 1899, 263). Diazotised *o*-anisidine gives, on cotton impregnated with β-naphthol, a violet-brownish colour; the diazotised base, $OCH_3.NH_2.Cl = 1.2.5$, differs only slightly from this; whilst the 1.2.4 base gives a much less violet and brown colour.

By replacing the amido group in *m*-nitro-*o*-anisidine by hydrogen, reducing the nitro compound, and replacing the amido group by chlorine, the authors have prepared *m*-chloranisol, which they find is a slightly yellow oil volatile with steam. It boils under 728 mm. at 192° C., whilst the *o*-derivative boils at 198° C. and the para at 194° C. The three compounds are readily distinguishable by their nitro products. The *o*-compound gives *o*-chloro-*p*-nitranisol, crystallising in white needles melting at 95° C. and not volatile with steam; the *p*-derivative gives *o*-nitro-*p*-chloranisol, which forms slightly yellow needles melting at 98° C. and volatile with steam; whilst *m*-chloranisol yields a nitro derivative also volatile with steam and crystallising in long yellow needles melting at 58° C.

—T. A. L.

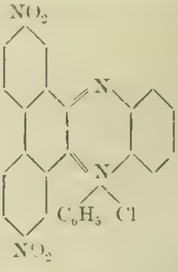
Rosinduline, Eighth and Ninth Isomerides of. F. Kehrmann and P. Filatoff. Ber. 32, [14], 2627—2633.

When phenylnaphthophenazonium nitrate is acted on by strong nitric acid for 3—4 hours at 0° C., a mixture of nitro compounds is formed, from which two mononitro derivatives, amounting to 90 per cent. of the theoretical, can be isolated as chief products. These have not been further investigated, but the amines they yield on reduction have been characterised as rosindulines different from any of the known isomerides. The two nitro compounds differ in their solubilities in cold water and alcohol. The sparingly soluble nitrate, on reduction with stannous chloride and hydrochloric acid in alcoholic solution, gives a precipitate of the tin double salt of the leuco-amido compound, from which the Isorosinduline chloride No. 8 can be obtained by dissolving in water and passing air through. The chloride, $C_{22}H_{16}N_3Cl$, forms short violet prisms soluble in water with a greenish-blue and in alcohol with a pure blue colour. The solution in sulphuric acid is golden-yellow, passing through yellow to green on adding water, and turning blue on neutralisation. The solutions, which taste bitter, do not fluoresce. On reducing the easily soluble nitrate in the same way, the chloride of Isorosinduline No. 9 is obtained, which dissolves in water with a dark blue and in alcohol with a bluish-green colour, being more soluble in both solvents than the Isorosinduline No. 8. The solution in sulphuric acid is blood-red, turning yellow and then violet-blue on dilution. With regard to the constitution of the Isorosindulines 8 and 9, since three of the 13 possible amidophenylnaphthophenazoniums are known in which the amido groups are in the positions 2, 3, and 6 (this Journal, 1899, 130), there are 10 available positions. Of these, three (11, 12, and 13) are improbable, since it is known that the introduction of an amido group into the phenyl group has little influence on the colour, whereas here the change is very great. Most probably the groups are in the positions 1, 4, or 5, since when β-naphthoquinone is nitrated the nitro group enters ortho to one oxygen; and, moreover, the introduction of an amido group ortho to the azine or azonium nitrogen gives rise to a green colour, of which the green isophenosafranine already described is an example. It is, however, possible that the positions 7, 8, 9, or 10 are replaced, since phenanthraquinone gives a dinitro compound which condenses to a green azonium compound, described in the next abstract.—T. A. L.

Nitro- and Amido-Flavindulines. F. Kehrmann and Z. Kikine. Ber. 32, [14], 2633—2637.

On suitably treating phenanthraquinone with fuming nitric acid it yields several nitro derivatives, of which a mononitro derivative melting at 162° C. and a dinitro compound melting at 279° C. are the principal products. The authors describe in the present paper the azonium compounds obtained by condensing these products with phenyl-*o*-phenylene diamine. *Nitroflavinduline* in which the position of the nitro group has not been fully determined is obtained by condensing 10 grms. of nitrophenanthraquinone with one molecular proportion of phenyl-*o*-phenylene diamine hydrochloride in 50 c.c. of glacial acetic acid. When the solution has become clear, water is added, and, after filtering, the azonium compound is precipitated as a yellow crystalline powder, which can be purified by dissolving in alcohol and fractionally separating from the dinitro product formed simultaneously by precipitation with ether. It crystallises in transparent amber-coloured prisms very easily soluble to yellow non-fluorescent solutions in water and alcohol, and is insoluble in ether. The solution in concentrated sulphuric acid is blood-red, passing through brownish-red to lemon-yellow on dilution. On reduction with stannous chloride, treatment with ferric chloride, and precipitation as the bromide, amidoflavinduline having the formula $C_{26}H_{18}N_3Br$ is obtained, which forms dark green needles dissolving in water with a greenish-brown colour. The salt dissolves in concentrated sulphuric acid with a dirty purple colour, becoming lemon-yellow on dilution and olive brown on neutralisation.

The condensation of dinitrophenanthraquinone and phenyl-*o*-phenylene diamine hydrochloride in glacial acetic acid yields dinitroflavinduline chloride having the formula —



The product forms small lemon-yellow prismatic crystals sparingly soluble in water, more easily in hot alcohol and glacial acetic acid to non-fluorescent solutions. The solution in concentrated sulphuric acid is brownish blood-red, becoming yellow on dilution. On reduction, as in the case of the mononitro derivative, the corresponding diamidoflavinduline bromide is obtained, crystallising in steely blackish-green prisms sparingly soluble in water and alcohol to yellowish-green non-fluorescent solutions. The solution in concentrated sulphuric acid is brownish blood-red becoming golden-yellow on dilution and yellowish-green on neutralisation.—T. A. L.

Naphthopurpurin (Naphthazarin). G. F. Jaubert. Comptes Rend. 1899, 129, [18], 684—686.

The action of nitric acid on naphthazarin (Alizarin Black) yields an oxidation product which the author terms naphthopurpurin, since alizarin on oxidation yields purpurin. It possesses the constitution of a trihydroxy-α-naphthoquinone, $1.4.1'.2'.4'.C_{10}H_3O_2(OH)_3$, and is best obtained by mixing 1 part by weight of naphthazarin with 2 parts of manganese dioxide, and adding 2 parts of concentrated sulphuric acid. The reaction is complete when a sample diluted with water and saturated with ammonia gives a magenta instead of a blue coloration. The melt is then poured on to ice, and the reddish precipitate is filtered off and dried on the water-bath. The crude product weighs $1\frac{1}{3}$ part, and is purified by crystallisation from glacial acetic acid or by sublimation. The sublimed product forms reddish-brown needles, which melt easily on platinum foil, giving a reddish vapour and smelling of quinone. It can also be crystallised from hot water, and the yellowish-brown solution so obtained, on treating with zinc dust, is decolorised, yielding probably 1.4.1′.2′.4′-pentahydroxynaphthalene. Similar to its analogue Purparin, Naphthopurpurin dyes mordanted cotton carmine and chromed wool brown from an acetic acid bath. The following table shows in what respects the new dyestuff differs from naphthazarin :—

	Naphthopurpurin.	Naphthazarin.
Solution in concentrated sulphuric acid.	Cherry red	Purple
Solution in ammonia	Magenta	Blue
,, potash alum.......	Carmine	Violet
,, cold water.........	Yellowish-red	Insoluble
,, glacial acetic acid .	Reddish-yellow	Magenta
Colour of the alumina lake	Carmine	Violet

The new product also gives an acetyl and a benzoyl compound.—T. A. L.

Phenols, Estimation of, by Bromine. W. Vaubel. Zeits. für angew. Chem. 1899, [43], 1031.

See under XXIII., *page* 1158.

PATENTS.

Indigo Colouring Matters and Intermediate Products, Impts. in the Manufacture of. G. B. Ellis, London. From La Société Chimique des Usines du Rhône ancien. Gilliard P. Monnet et Cartier, Lyons, France. Eng. Pat. 25,634, Dec. 5, 1898.

The specification relates to the preparation of a methyl indigo obtained by nitrating *m*-toluic aldehyde, condensing the nitro-aldehydes with acetone, and treating the ketones so formed with caustic alkalis. 2 kilos. of *m*-toluic aldehyde are dissolved in 20 kilos. of concentrated sulphuric acid at about 40° C., and 1·44 kilo. of dry sodium nitrate is then stirred in at 40°—45° C. When the nitration is complete, the melt is poured on to ice, and the product, after washing with water and carbonate of soda, weighs about 2½ kilos. It is then fractionally distilled under 2 mm. pressure, the whole distilling at 135°—145° C. The first two-thirds of the distillate yield a product, after cooling to 0° C., melting at 64° C.; whilst the last third, when similarly treated, gives a nitro-aldehyde melting at 44° C., which crystallises from alcohol in yellow needles. The former, on gentle oxidation, yields the corresponding acid, melting at 220° C., having the constitution $CH_3 : CO_2H : NO_2 = 1:3:4$; whilst the latter, when similarly treated, gives an acid melting at 135° C., and having probably the constitution 1:3:2. In order to obtain the ketones from these aldehydes, 5 parts are dissolved in 8 parts of acetone, cooled to 0°, and mixed with 1½ parts of caustic soda in 100 parts of water under constant agitation for about 30 minutes. The mixture is then made acid, the excess of acetone removed by distillation, and the ketone purified by recrystallisation. The yield in either case is theoretical, the product from the 64° C. aldehyde melting at 79° C., and from the 44° C. aldehyde at 104° C. When treated with dilute solutions of alkalis, these ketones are converted into methyl-indigos, the transformation of the former taking place much more readily than that of the latter. For example, 6 parts of the ketone, melting at 104° C., are stirred for several hours in 100 parts of 8 per cent. caustic soda lye. The precipitated indigo dyestuff is then filtered off, washed, and dried. It weighs about half the weight of the ketone taken, and dyes a very violet shade. In the case of the nitrotoluic aldehyde, melting at 64° C., it is not necessary to isolate the ketone. 5 parts of this aldehyde are dissolved in 10 parts of acetone, and 125 parts of a 2 per cent. caustic soda lye are added. The precipitated indigo dyestuff is treated as above, and gives, in light shades, a greenish tint, whilst heavier shades show a coppery reflex. Both these indigo dyestuffs are readily reduced by sodium hydrosulphite, and may be employed in ordinary indigo vats.—T. A. L.

Indigo, Impts. in the Manufacture of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 25,966, Dec. 8, 1898.

Polyhydric alcohols of the fatty series and allied polyhydroxy compounds, as well as their esters, on melting together with anthranilic acid or its salts or esters, yield leuco compounds of indigo. Such fatty compounds are glycerol, *a*-chlorhydrin, epichlorhydrin, acetine, glycol mannite, various kinds of starch, cellulose, and sawdust. Instead of the free hydroxy compounds, their salts may be used, such as calcium, sodium, or potassium glycerate, and in these cases it is not necessary to add an alkali to the melt. A mixture of 1 kilo. of anthranilic acid, 2 kilos. of glycerol, and 4 kilos. of caustic potash is rapidly heated to 250°—300° C., and kept at this temperature until the melt becomes yellowish to brownish-red in colour. It is then allowed to cool, dissolved in water, and the indigo is separated in the usual manner. The following is a modification of this method:—About 1 kilo. of potassium anthranilate and 3 kilos. of potassium glycerate are mixed together and heated to about 270° C. until no more gas is evolved and the melt turns yellowish-red. It is then worked up for indigo in the usual manner. The melt may also consist of 1 kilo. of potassium anthranilate, 2 kilos. of potassium glycerate, 2 kilos. of caustic potash, and 4 kilos. of caustic lime. On heating to 270°—290° C. the reaction proceeds quietly. When complete the melt is cooled, dissolved in water out of contact with the air, filtered from the lime, and air passed through the filtrate until all the indigo has separated.—T. A. L.

Disazo Colouring Matters [Blue, Violet-Black] and of Products for Use therein, Impts. in the Manufacture and Production of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 25,650, Dec. 5, 1898.

The secondary disazo dyestuffs herein described are derivatives of chloramidophenol sulphonic acids and of chloramidophenol. These, after diazotisation, are combined with naphthylamine or its sulphonic acids (1.3′ or 1.2′ or mixtures thereof), or other amido compounds capable of yielding an amido-azo compound which can be readily rediazotised and combined with an ordinary end or final component. The chloramidophenol sulphonic acid, which is preferably employed, is obtained from nitro-amidophenol sulphonic acid. This is diazotised, treated with molecular copper in hydrochloric acid solution, and then reduced to the chloramidophenol sulphonic acid required. This acid is slightly soluble in cold water, more readily in hot, from which it separates in short, thick crystals. The diazochloride is soluble in water, the solution showing a green dichroism.

The combinations are carried out in the manner usually applied for obtaining disazo dyestuffs, and the products obtained dye wool deep blue to violet-black shades. They possess considerable covering power, and are fast to light; this property may be increased by subsequently treating the dyed goods with chromates, when the shade also changes slightly towards green or blue.—T. A. L.

Disazo Colouring Matters [Blue-Black, Violet-Black], Impts. in the Manufacture and Production of. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 26,262, Dec. 12, 1898.

The nitro-amidophenols employed in this invention are the *o*-nitro-*p*-amidophenol of Huebner (Annalen, **210**, 381), and the *o*-amido-*p*-nitrophenol of Stuckenberg (Annalen, **205**, 75). Both these nitro-amidophenols can be readily diazotised and combined to form disazo dyestuffs according to the method already described in Eng. Pat. 25,650 of 1898 (see above). The same middle components may be employed, and as end components those most suitable are 2.3.3′-naphthol disulphonic acid 1.4- and 1.4′-naphthol sulphonic acid, *a*-naphthylamine, and 1.1′.4-dihydroxynaphthalene sulphonic acid. The dyestuffs give blue-black and violet-black shades on wool.—T. A. L.

Trioxynaphthalene, and Dyestuffs derived therefrom; The Production of a New. R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfort-on-the-Main, Germany. Eng. Pat. 27,345, Dec. 27, 1898.

On heating 2.3.1′.3′-trihydroxynaphthalene sulphonic acid (obtained by fusing 2.3.3′.1′-naphthol trisulphonic acid with alkalis) with water to above 160° C., it is converted into a new trihydroxynaphthalene, having the hydroxyl groups in the positions 1.2′.3′. For example, 27·5 kilos. of trihydroxynaphthalene sodium sulphonate, 9·8 kilos. of sulphuric acid (66° B.), and 200 litres of water are heated in an autoclave for five hours to 210—220° C. On evaporating the solution, the trihydroxynaphthalene separates in small needles. It melts at 165° C., is tolerably easily soluble in water, and dissolves readily in alcohol and ether, but is scarcely soluble in benzene and chloroform. The triacetyl compound melts at 126° C. The alkaline solution is coloured dark brown by the atmospheric oxygen, whilst ferric chloride produces an intense blue coloration. The trihydroxynaphthalene is a valuable dyestuff compound, since some of its azo derivatives dye on metallic mordants. For this purpose it is necessary that the azo combination takes place in a weak acid solution. The dyeings are said to be perfectly level, fast to acids, potting, and light. Thus 13·8 kilos. of *m*-nitraniline are diazotised and added to a solution of 18 kilos. of the trihydroxynaphthalene containing an excess of sodium acetate. After 12 hours the solution is heated to about 50° C., neutralised with sodium carbonate, and salted out. It gives fast brown shades on cotton mordanted with chrome or iron salts, or on wool mordanted with chrome.—T. A. L.

Azo Colouring Matters [Black], Manufacture of. O. Imray, London. From The Farbwerke vorm Meister, Lucius und Brüning, Hoechst a/M., Germany. Eng. Pat. 25,566, Dec. 3, 1898.

Diazotised picramic acid (Eng. Pat. 11,437 of 1898; this Journal 1899, 489) is combined with 2.3′.2′ amidonaphthol sulphonic acid, 1.1′.4.2′-amidonaphthol disulphonic acid, or with the alkyl derivatives of these acids, such as the 2.3′.2′-ethyl- or methylamidonaphthol sulphonic acids, or the 1.1′.3.3′-ethylamidonaphthol disulphonic acid. For instance, the diazo compound from 22·1 kilos. of picramic acid is added to a solution of 26·7 kilos. of 2.3′.2′-ethylamidonaphthol sulphonic acid made alkaline with soda. When the reaction is complete, the solution is boiled and the dyestuff salted out. It forms when dry, a brilliant greenish-black powder soluble in water to a bluish-red solution, which is not altered by alkalis. The solution in concentrated sulphuric acid is red. The dyestuff gives violet-black shades on wool, which on subsequent treatment with chromium compounds turn deep black.—T. A. L.

Monazo Dyestuffs [Black] for Wool, Manufacture of New O. Imray, London. From The Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/M., Germany. Eng. Pat. 1468, Jan. 21, 1899.

By combining acetylated amidonaphthol sulphonic acids with diazotised picramic acid the patentees obtain fast black dyestuffs for wool. The acids recommended for this process are the 1.1′.3.5′- and the 1.1′.4.3′-acetamidonaphthol disulphonic acids. Picramic acid is diazotised in the usual manner, and the diazo compound is added to a solution of the equivalent quantity of 1.1′.3.3′-acetamidonaphthol disulphonic acid made alkaline with sodium carbonate. After standing some hours, the dyestuff is salted out, pressed, and dried. It gives black shades on wool and may be developed dark olive-green by development with chromium compounds. The dyestuffs are said to be much faster to light than those obtained from the non-acetylated acids.—T. A. L.

Brown Dyestuffs for Wool, Manufacture of. O. Imray, London. From The Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/M., Germany. Eng. Pat. 198, Jan. 4, 1899.

The patentees obtain these new dyestuffs by the action of the 1.2.3.5-, 1.2.5.3-nitro-amidophenol sulphonic acids, picramic acid, or amidophenol sulphonic acid on *m* phenylene or *m*-tolylene diamine, or their sulphonic acids. If wool dyed with these dyestuffs be subsequently treated with bichromate, the depth of shade increases, and the dye becomes much faster. For example, 19·9 kilos. of picramic acid are diazotised and added to a solution containing 18·8 kilos. of *m*-phenylene diamine sulphonic acid and 26 kilos. of sodium acetate. After 12 hours the dyestuff is salted out. It forms a brown powder soluble to a reddish-brown solution, which becomes yellower on adding alkalis. The solution in concentrated sulphuric acid is carmine red.
—T. A. L.

Dyestuffs [Black] from Dinitroanthrachrysone, Manufacture of. O. Imray, London. From The Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 286, Jan. 5, 1899.

According to Eng. Pat. 9506 of 1898 (this Journal, 1899, 363) tetranitroanthrachrysone reacts with aromatic bases. The patentees now find that dinitroanthrachrysone reacts in a similar way, the nitro groups being replaced by basic residues. The reaction is thus essentially different from that described in Eng. Pat. 23,927 of 1894 (this Journal, 1895, 1041), which relates to the replacement of hydroxyls by aromatic bases. A mixture of 3·62 kilos. of dinitroanthrachrysone, 36 litres of water, 2·18 kilos. of *o*-amidophenol, and 2·1 kilos. of sodium carbonate is heated on the water-bath until the colour of the solution no longer changes. The dyestuff gives red shades on chrome mordanted wool, its sodium salt has a bordeaux colour, the solution in concentrated sulphuric acid is reddish violet and in fuming sulphuric acid (20 per cent. SO_3) is bluish-violet.—T. A. L.

Indoxyl methylketone, [Indigo] Manufacture of. O. Imray, London. From The Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 1034, Jan. 16, 1899.

According to Eng. Pat. 9690 of 1898 (this Journal, 1899, 362) indoxyl carboxylic esters can be obtained from neutral phenyl glycine *o*-carboxylic esters, by the action of sodium alcoholate or metallic sodium. This formation of indoxyl derivatives also takes place if *o*-amidocarboxylic esters containing the group $CH_2.CO$ attached to the nitrogen atom. Of these compounds the only important ones are acetonylanthranilic esters, obtained by heating one molecular proportion of halogenacetone with two molecular proportions of anthranilic ester. The following are the quantities employed:—330 kilos. of ethylanthranilate and 92·5 kilos. of chloracetone are heated on the water bath until the latter has disappeared, when a solution of 55 kilos. of sodium carbonate is added. The mixture of ethylacetonylanthranilate and ethylanthranilate is dissolved in 1,000 kilos. of benzene and warmed gently with 23 kilos. of finely divided metallic sodium. When the latter has disappeared the mass is allowed to cool, and shaken with dilute acid. The benzene solution is then treated with dilute soda lye, from which the indoxyl methyl ketone may be precipitated by acetic or dilute mineral acid. It forms a pale-yellow substance, melting at 153° C., is readily soluble in ether, alcohol, or benzene, and sparingly soluble in chloroform. When heated with caustic alkalis a yellow mass is obtained, the aqueous solution of which yields indigo on exposure to air. The ketone dissolves to a yellow solution in concentrated sulphuric acid, turning blue on heating, due to the production of indigo. The substance also yields a hydrazone with phenylhydrazine.—T. A. L.

Blue Basic Dyestuffs Soluble in Water. O. Imray, London. From the Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 1766, Jan. 25, 1899.

In Ger. Pats. 85,932, 91,721, 92,015, and 95,483, processes are described for obtaining blue dyestuffs more or less soluble in water, by combining equimolecular proportions of a diazotised safranine and naphthol. In the present specification the patentees describe the preparation of valuable blue dyestuffs soluble in water, by combining two molecular proportions of a diazotised safranine with one molecular proportion of β-naphthol in a neutral, slightly acid or ammoniacal solution. The safranines suitable are phenosafranine and its homologues, known commercially as Safranine G extra, HN extra, concentrated, GGS, B, T, &c. For instance, 14 kilos. of Safranine G extra (0·04 mol.) are dissolved in water and diazotised with 9 kilos. of hydrochloric acid (20° B.), and 2·76 kilos. of sodium nitrite (100 per cent.), after cooling with ice. When the diazotisation is complete, a solution of 3 kilos. (0·02 mol.) of β-naphthol in 4 kilos. of soda lye (sp. gr. 1·437) and 50—100 litres of water is run into the diazo solution, with constant stirring. The formation of the dyestuff is complete in about 12—24 hours, when the temperature is raised to 70—80° C. and the solution is, if necessary, filtered. The dyestuff is then salted out, filtered, washed with brine, pressed, and dried. It dissolves readily in water to a bluish-violet solution and dyes unmordanted cotton or cotton mordanted with tartar emetic a fast blue. It also gives the same colour on wool or half wool.—T. A. L.

Azo Colouring Matters [Blue, Green, Black], Impts in the Manufacture of. H. H. Lake, London. From The Chemical Works, formerly Sandoz, Basle, Switzerland. Eng. Pat. 8503, April 22, 1899.

The monazo dyes obtained in an acid solution from the diazotised 1.2.4-, 1.2.5-, and 1.3.4-amidodichlorobenzenes and 1.4.3.3′-amidonaphthol disulphonic acid H are of no particular value for dyeing and printing. If, however, they are combined with tetrazo compounds, the intermediate products on further combination with other components yield valuable blue, green, and black dyestuffs for unmordanted cotton, which are distinguished by their brilliancy and fastness to alkalis. For example, 34·1 kilos. of the acid sodium salt of 1·1′·3·3′-amidonaphtholdisulphonic (100 per cent.) are dissolved in 400 litres of water together with 5 kilos. of sodium carbonate, and then precipitated with 30 kilos. of hydrochloric acid (21° B.). This is then combined with the diazo compound from 16·25 kilos. of 1.4.3-dichloroaniline, 6·9 kilos. of sodium nitrite, and 300 litres of hydrochloric acid (7·3 per cent.), and the reddish-brown paste obtained is mixed with the tetrazodiphenyl solution from 18·4 kilos. of benzidine, the whole being then poured into 80 kilos. of sodium carbonate in 800 litres of water. The combination is complete in about an hour, when the black precipitate of the intermediate compound is combined with the solution of 34·1 kilos. of 1·1′·3·3′-amidonaphthol disulphonic acid H (100 per cent. acid sodium salt) in 400 litres of water and 4 kilos. of caustic soda. The reaction is complete in about 20 hours, with occasional agitation. The dark blue, somewhat gelatinous, mass, is heated to boiling, and the dyestuff precipitated with 20 kilos. of salt. The new triazo dyestuff gives blue shades on unmordanted cotton from a neutral or slightly alkaline bath, and also on wool and silk from a neutral or acid bath in presence of sodium sulphate or salt.

—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Spontaneous Combustion of Oily Cotton and Wool, &c. Leipziger Färber- u. Zeugdr.-Zeit. 1899, **48**, 435.

Herzfeld has studied this action, and states that the combustion of materials other than those composed of vegetable fibres, which are apt to ignite when exposed under certain conditions to air, can be demonstrated. Two stages are recognised in the action: first, a stage in which there is a direct combination with oxygen attended by an evolution of heat, followed by a second, in which ignition occurs.—E. B.

PATENTS.

Cocoa- and like Fibres, Ingredients for Treating, in Imitation of Hair for Upholstery. E. Horsey, Sidcup, Kent. Eng. Pat. 18,126, Aug. 23, 1898.

Clean carded cocoa, or other vegetable fibres, are washed in water, impregnated with a solution of alum, again washed in cold water, and dried at about 80° C. The product is next immersed in a bath of borax, 6 to 8 oz.; gum arabic, 4 oz.; lac, 2½ lb.; water, 1 gall., with or without a dye, and dried once more. The treatment is claimed to render the fibre impervious to moisture, free from tendency to harbour insects, and resilient; so that it makes a good substitute for hair in stuffing mattresses and upholstery in general.—F. H. L.

Yarn, Paper, Cloth, or other Fabrics by means of Chemical Solutions or other Liquids, Machinery for the Continuous Treatment of. B. G. Ermen, Manchester Eng. Pat. 23,325, Nov. 5, 1898.

The acids, solutions, or other liquids are contained in a series of vats or other receptacles through which the material to be treated is drawn. To prevent injury of the material by the acid, &c., in case of a temporary stoppage of the machine, the draw-through rollers are combined with means for automatically lifting the material from the first vat and transferring it to an adjoining one when the machine is stopped, and for retransferring it to the first vat when the machine is started again. The material is also drawn forward for a certain length before being re-submerged, to prevent a second treatment of that part withdrawn from the acid when the machine is stopped.—R. A.

Fabrics, Composition for Rendering Fireproof. H. Wigley, London. Eng. Pat. 3081, Feb. 11, 1899.

A liquid for impregnating and fire-extinguishing purposes is made by adding 10 drops of creosote to a solution of 3 lb. ammonium chloride in seven pints of boiling water. To mix with distemper colours, stated proportions of gum arabic and of acetic acid are added to a solution of ammonium chloride.—E. S.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Bleaching of Vegetable Fibres by means of Peroxide of Hydrogen. H. Koechlin. Bull. Soc. Ind. de Mulhouse. Aug. Sept. Oct. 1899, 271.

The scouring liquor, consisting of 1,000 litres of water, 10 kilos. of soap, 1 kilo. of calcined magnesia, and 30 kilos. of peroxide of hydrogen to every five pieces, is forced through the cloth in a Mather and Platt bleaching kier, at a pressure of 2 atmospheres, for 3—6 hours.

The pieces are washed, soured, and again well washed.

The process may be modified by passing the cotton through a solution of peroxide of baryta, and subsequently through dilute sulphuric or hydrochloric acid, after which it is bleached in a kier as above, only omitting the addition of peroxide to the liquor.

Another method is to bleach in the kier, omitting the peroxide, through which the pieces are subsequently passed as a separate process.

The white is said to be vastly superior to that obtained where hypochlorites are the bleaching agents, and there is no tendering action on the fibre.—J. A. P.

Bleaching Mercerised (Glossed) Cotton Yarns with Sodium Peroxide. Leipziger Färber- u. Zeugdr.-Zeit. 1899, **48**, 435.

50 kilos. of unbleached cotton yarn, after being treated under tension with a concentrated solution of caustic soda, are introduced into a bath composed of 450 litres of water, 1·35 kilos. of sulphuric acid at 66° B., 1 kilo. of sodium peroxide, and 0·125 kilo. of sodium silicate. The bath is thereupon heated to 54°—55° C. and maintained at this temperature for 2¼ hours. The yarn is then withdrawn, rinsed in hot water, soaped, and rinsed a second time.

The bleach bath may be employed five or six times in succession in this manner, one-third of the quantities of materials used in setting it being added for the second and subsequent lots of cotton. It must be slightly alkaline to be effective, but an excess of alkali is to be avoided, as it renders the cotton harsh to the touch.—E. B.

Aniline Black, Use of Lactic Acid in Dyeing. Leipziger Färber- u. Zeugdr.-Zeit. 1899, **48**, 462—464.

The employment of aniline lactate in producing Aniline Black upon cotton is the subject of Ger. Pat. 96,600.

In the steaming or steam-ageing process of producing Aniline Black upon cotton fabrics, from mixtures containing aniline hydrochloride, the hydrochloric acid which is liberated injures the fibre more or less. Endeavours have been made to replace the salt, at least partially, by the aniline salt of an organic acid, particularly aniline tartrate. The lactate, however, offers greater advantages for the purpose. Besides having less action upon the fibre than the tartrate, it is more soluble than this, and when dried upon the fibre, it does not, like this salt, leave a crystalline coating which resists the action of the oxidising agents.

Further, aluminium acetate is sometimes added, with the same object of protecting the fibre from injury, to the mixture of aniline hydrochloride and oxidising salts. In this case a precipitate of a dark green aniline-copper compound is formed. In the operation of drying, again, the acetate is decomposed and alumina is deposited upon the fibre, rendering it stiff. These drawbacks are not met with when aluminium lactate is used. The padding solution remains clear, and the fabric, when dried, is soft and pliable. Moreover, the black is produced slowly and regularly.

Owing to their viscosity, it is stated, the solutions which contain lactates penetrate the cotton fibre very readily.

Aluminium lactate may be prepared by mixing together a solution of 100 grms. of aluminium sulphate in 200 c.c. of water with a solution of 175 grms. of barium lactate in 300 c.c. of water.

The following is a mixture suitable for the production of Aniline Black :—120 grms. of aniline hydrochloride (or 60 grms. of aniline hydrochloride and 85 grms. of aniline lactate) dissolved in 600 c.c. of water, 30 grms. of copper nitrate dissolved in 300 c.c. of water, 100 grms. of sodium chlorate dissolved in 450 c.c. of water, and 90 grms. of ammonium chloride in 300 c.c. of water. Ten parts by volume of this are taken and mixed with 1 part by volume of the solution of aluminium lactate prepared as above described. 1 kilo. of the cotton yarn to be dyed is immersed in 4 kilos. of the latter mixture, and is dried on a reel or winch at 20°—25° C. It is then placed for four hours in a dark room where it is exposed to an atmosphere of air and steam at 50° C. A dark green colour is so produced, and is converted into a black by working the yarn for a short time in a solution of 50 grms. of potassium bichromate in 8 litres of water and then leaving it immersed therein for 24 hours. A more intense colour, which is fast to acids, is obtained by treating the yarn thus dyed, in a bath of 3 per cent. (of the weight of the yarn) of potassium bichromate, 1 per cent. of aniline hydrochloride, 0·5 per cent. of toluidine hydrochloride, 2 per cent. of lactic acid and 1·5 per cent. of sulphuric acid, for an hour at the ordinary temperature, and for another hour while the bath is heated to 80° C., afterwards rinsing and soaping at 60° C.

The relative strengths of yarns of the same kind, dyed Aniline Black in the above manner, from mixtures containing respectively aluminium acetate, aluminium lactate, and aniline lactate, as determined at the silk-conditioning establishment at Crefeld, are in the ratio 81:84:87.—E. B.

A Nitroso Blue Reserve for Paranitraniline Red.

Leipziger Färber- u. Zeugdr. Zeit. 1899, **48**, 443.

The cotton tissue to be printed is padded in a solution of 250 grms. of Naphthol R. (Eng. Pat. 16,987 of 1894, this Journal, 1895, 803), 500 c.c. of caustic soda-lye at 22° B., and 200 grms. of "Para Soap PN," with water to make 10 litres. It is printed with a mixture of 6,000 grms. of "acid starch thickening :" (*a*) 300 grms of Nitroso Base M, 50 per cent. paste (Nitrosodimethylaniline), 460 c.c. of water, 160 grms. of oxalic acid, 600 grms. of an aqueous solution of tannic acid (10:10) ; (*b*) 180 grms. of 2·2′-dihydroxynaphthalene, 160 grms. of oxalic acid, 1,600 c.c. of water ; (*c*) 25 grms. of Crystal Violet, 15 grms. of Methylene Blue DB, 400 c.c. of water, and 100 c.c. of acetic acid at 8° B. The several portions, *a*, *b*, *c*, of this mixture are separately mixed before being incorporated with the thickening. The printed tissue is steamed for 1—1½ minutes, in order to develop and fix the blue, and is then passed through a solution of diazotised paranitraniline (140 grms. in 10 litres), being afterwards washed, passed through a solution of tartar emetic, washed, and soaped. The diazotised paranitraniline is applied to the tissue as it passes, with its printed surface uppermost between the squeezing rollers of a padding machine, being conveyed to it in the quantity necessary for this purpose by means of an endless band of thick felt which travels from the vessel in which the solution is contained round the lower of the rollers. An olive colour is obtained from a mixture of Nitroso Blue, Brilliant Green, and Auramine.

Nitroso Base is now supplied as a 50 per cent. paste, as in this form it is found to keep better and to be less injurious to the skin of those who have to handle it.—E. B.

Turkey-Red, New Process for Dyeing. H. Koechlin.

Bull. Soc. Ind. de Mulhouse, Aug., Sept., Oct. 1899, 267.

The pieces are mordanted in a bath made up of 1 litre of acetate of alumina (15° Tw.), 2 litres of water, 375 c.c. of acetate of lime (28° Tw.), 65 c.c. of acetate of magnesia ; after which they are passed into a cold bath containing 1 litre of silicate of soda (32° Tw.), 10 litres of water, and 250 c.c. of ammonia.

They are then well washed, dried, and padded with the following mixture :—1 litre of alizarin, 3 litres of thin gum-water; 50 c.c. of caustic soda (70° Tw.), 250 c.c. of acid sulphated oil,* and 100 grms. of phosphate of soda.

According to the concentration of the alizarin taken, more or less water may be added to the above, but it must be remembered that every litre of water used requires a further addition of 20 grms. of phosphate of soda.

After padding, steam 2—2½ hours, soap, sour, &c.

The reds obtained compare favourably with those by the ordinary Turkey-red process, and are cheaper to produce.

—J. A. P.

Turkey-Red, Rapid Process for Dyeing a Bright. H. Koechlin.

Bull. Soc. Chim. de Mulhouse, Aug., Sept., Oct. 1899, 268.

To brighten the ordinary Turkey-red, the mordanted cloth must be submitted to soaping for several hours.

The following process, entirely avoiding the use of soap, is said to give a satisfactory result :—

The cloth or yarn is passed through a bath containing 25 per cent. ammoniacal Turkey-red oil, then dried, steamed, passed into a neutral solution of sulphate of alumina, and finally washed, when it should pass direct into the dyebath containing (per 100 m. cloth) 2 kilos. of alizarin, 2 kilos. of acetate of lime (28° Tw.), 500 grms. of acid Turkey-red oil, and 4 kilos. of stannic oxide or metastannic acid.

The inventor attributes the brightness of the red to the employment of oxide of tin, which he prepares from diluted "nitromuriate of tin" by precipitation with carbonate of soda.

The red may be further improved by a final passage through neutral sulphated oil, followed by steaming.

—J. A. P.

Chrome Mordant, A New. Maurice de Gallois.

Bull. Soc. Ind. de Mulhouse, Aug., Sept., Oct. 1899, 255—256.

Chromium oxide (Cr_2O_3) dissolved in a soluble chromate is easily given up to the textile fibre in such a way that it can be subsequently fixed by simple washing in water or very dilute soda solution.

It is supposed that the chromium oxide and the chromate combine to the unstable "chromium chromate," which, in presence of alkalis or excess of water, splits up into its constituents, of which the insoluble oxide attaches itself to the fibre.

The method is said to be equally suitable for the application of oxides of aluminium, and possibly even of iron, to the fibre, and it is suggested that by judicious admixtures of the oxides in varying proportions, and subsequent dyeing with, *e.g.*, "Alizarin Y," an elaborate series of shades may be obtained.

Application of the Mordant.—After impregnation in the chromium chromate solution, continuous steaming for 7—15 min., or suspension during 12—24 hours in chambers heated up to 35°—40° C., suffices to completely fix the mordant. Subsequently a 2—3 min. passage through hot (70°—80° C.) carbonate of soda solution (10 grms. of soda crystals per litre) to remove stiffening, &c., is to be recommended, after which the goods should be well washed.

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* To prepare the sulphated oil, add 2 litres of sulphuric acid to 10 litres of olive oil, in small portions at a time, after which dilute to 300 litres, precipitate by addition of salt, and filter.

The new mordant may be prepared as follows :—

A solution of 1,000 grms. of chrome alum is heated with 800 grms. of soda crystals; the precipitate is well washed and dissolved in 200 grms. of sulphuric acid (168° Tw.). The solution is now diluted till it shows 13°—14 Tw., when it will contain approximately 3 per cent. of Cr_2O_3.

Additions of 148 grms. of bichromate of potash, and finally of 200 grms. of acetate of soda, are now made. It is a necessary precaution not to add the bichromate till after dilution, or the fibre is very likely to become tendered in the subsequent steaming operation.

In printing, the new mordant is applied as follows :—75 grms. of starch, 25 grms. of wheat flour, 1 litre of chromium sulphate, 13½° Tw. (prepared as above), and 10 c.c. of olive oil, are well mixed, boiled, and cooled, after which 30 grms. of bichromate of potash and 40 grms. of acetate of soda are added.

This mixture may be used diluted or in its original strength, according to requirement. For example, for use with "Fast Violet" (Durand, Huguenin, and Co.), 2 parts of thickened water with one of the mixture will give a deep shade.

The following white reserve is recommended for use in conjunction with the above printing mixture :—5 kilos. of dark brown starch, 8 litres of water, 4 kilos. of cryst. citric acid, 100 grms. of olive oil.—J. A. P.

Mordants [Chromium Chromates, &c.] of Maurice de Gallois. Henri Schmid. Bull. Soc. Ind. de Mulhouse, Aug., Sept., Oct. 1899, 257.

ALTHOUGH it is 25 years since Chas. Gros-Renaud first brought to notice the mordanting properties of chromium chromate, it is due to the recent efforts of Maurice de Gallois (who has discovered a very simple method of preparing it, and thrown much light on its action as a mordant) that it is coming generally into use on the large scale.

In preparing chromates of chromium according to the method of M. de Gallois—*viz.*, by double decomposition between ordinary salts of the oxide Cr_2O_3, in which the chromium plays the part of a base, and alkali chromates, in which the chromium of the acid radicle is derived from the anhydride CrO_3—bodies result which contain chromium in both the base-forming and acid-forming conditions, and of these Cr_2O_3, $3CrO_3$ is the normal type.

These bodies readily impart their Cr_2O_3 to the fibre by passing air or steam through the solutions, or even by mere contact with the fibre. The rinsing in water or dilute soda completes the fixation by entirely removing all CrO_3.

As a self-fixing mordant requiring no "assistants," and possessing a powerful attraction for colouring matters, chromium chromate very nearly approaches H. Koechlin's excellent alkaline chrome mordant, which gives up practically all its chromium to the fibre.

Of course, in the case of de Gallois' product, the action of the chromic anhydride is in a sense catalytic, since in bulk it merely serves as a vehicle whereby the chromium oxide reaches the fibre, and is for the most part carried away during washing, although it is possible that a small proportion may be changed into an insoluble basic oxide, or become reduced to the lower chromium oxide, and so fix itself within the fibre.

It must be noted that chromium mordants prepared by the method of de Gallois are not presented to the trade as pure chromium chromates, but rather as chromium-chromate-hydrochlorides, and chromate-acetates, the latter yielding up the greater proportion of chromium to the fibre.

As compensation for the loss of chromium incurred, chromium chromates have the advantage of complete immunity from caustic alkali, which in Koechlin's mordant is apt to tender and shrink the fibre considerably, as well as rendering its application to yarn a matter of difficulty, whereas the ease with which the chromium chromates are applied, is such as to have already brought about their employment in considerable quantities by the trade.

The following method is recommended :—Pad the previously well-scoured cotton overnight in chromium chromate, hang up wet for some hours, and finally pass, still wet, through a soda solution (12—15 grms. of "crystal carbonate" per litre) at 50° C., after which wash well and dye.

The older process demanded a preliminary mordanting with tannin or oil (followed by drying where oil was used) in order to fix chromium oxide, or the chrome could be fixed in an alkaline bath. Owing to the presence of small quantities of chromic acid, the mordanted fibre is very sensitive to light and should not be exposed to direct sunlight, but, above all things, it must not be allowed to dry in the light before dyeing.

For mordanting cotton piece-goods, the chromium chromate-acetate is to be recommended, the hydrochloride being intended for yarn. A reducing agent, *e.g.*, glycerin, is usually added to the bath; after drying, the piece is passed rapidly through the Mather and Platt steaming apparatus, and scoured in dilute soda to remove glycerin, gum, &c., and impart a soft feel to the cloth.—J. A. P.

Brilliant Chrome-Red, Interesting Use of. C. Schwartz. Bull. Soc. Ind. de Mulhouse, Aug., Sept., Oct. 1899, 259.

A NEW use for this little used product has been discovered by the author.

It seems that the lake which the dye forms with chromium mordant is very sensitive to the action of oxidising agents, and this property is made use of in the following printing process, by which the Chrome Red, printed on a coloured ground, is in part discharged and substituted by other colours, previously chosen for the purpose. The following is the *modus operandi* :—

Pad the cotton with a chrome-mordanted colour, *e.g.*, Cœruleïn, steam for one hour, then print a design with a mixture of chlorate and prussiate of potash, and dry. Over this three discharge-colours (prepared by mixing small quantities of dyestuffs not sensitive to oxidation with the Chrome Red) are printed by means of a three-colour machine; the cloth is then steamed for 30 minutes, soaped, and washed.

Wherever the chlorate-prussiate comes in contact with the Chrome Red this will be destroyed, the other colour present, *e.g.*, Methylene Blue, appearing in its place.

The following discharge-colours are recommended :—

300 grms. of Chrome Red in paste ;

80 grms. of chromium acetate, 32° Tw.; and

For *yellow*, 36 grms. of Chrysophenine.

For *pink*, 36 grms. of Rhodamine.

For *blue*, 18 grms. of Methylene Blue.

For *green*, 12 grms. of Chrysophenine and 12 grms. of Methylene Blue.

On a white ground, one-eighth of the following mixture should be added to the discharge-colour for darkening purposes :—

One litre of thickening, 100 grms. of Alizarin Dark Blue S, 100 grms. of acetate of chrome, 32° Tw.

The colours are permanent.

The following suggestions as to the shades chosen may be found useful :—

Ground, blue or green; design, white (chlorate-prussiate mixture), and puce, buff, and black discharge-colours, changing to pink, yellow, and blue respectively wherever the different designs cross the white.

M. H. Bourry, in a paper read before the Soc. Ind. de Mulhouse, states that he has tried the new process, and is able to fully confirm Schwartz's investigations. He draws attention to the necessity for thorough soaping to prevent back-printing; but whilst allowing the interesting character of the process, he considers Chrome Red somewhat fugitive to light.—J. A. P.

α-Naphthylamine, A New Method of Printing Garnet. F. Oswald. Bull. Soc. Ind. de Mulhouse, Aug., Sept., Oct., 1899, 272.

THE general method of printing this colour is to pad in sodium β-naphthol and dry, print a tin salt resist on the cloth, and develop with diazo-α-naphthylamine.

An inconvenience of this method is that after padding, the printing and developing must be proceeded with almost at once, as an exposure of 48 hours suffices to turn the β-naphthol yellow, and the yellowing once begun will continue to develop after the goods are finished.

The new method consists in printing on the resist *before* padding, when the cloth can be kept for any length of time before completing the process.

An organic acid and paraffin wax are the essential constituents of the resist employed, the latter being intended to prevent entirely the penetration of the fibre by the β-naphthol; a subsequent washing in warm water removes any colour which may have developed superficially on the portions printed with the resist.

By employing this process, the many objections attending the use of tin salt are avoided, not the least of these being its continual rise in price, and further, the finished prints are not inclined to turn yellow.

The following is the method of preparing the white resist:—

Melt in 6 galls. of water, 12 lb. of glue, 12 lb. of paraffin wax; add 36 lb. of brown starch, mix well, then boil and dissolve 48 lb. of tartaric acid in the mixture, after which cool down to about 40° C., and add 3 quarts of turpentine.

The following coloured resists may also be recommended:—

Yellow.—Water, 6 galls.; glue, 8 lb.; paraffin wax, 8 lb.; nitrate of lead, 24 lb.; brown starch, 36 lb.; sulphate of lead paste, 1 quart; citric acid, 16 lb.; turpentine, 2 quarts. To be prepared in the same manner as the white resist; after printing, to be passed through bichromate, and washed before drying.

Green.—Add one part of Prussian-blue paste to eight parts of the yellow resist.

Blue.—Add a suitable proportion of Prussian-blue dissolved in oxalic acid to the white resist.

Black.—Aniline Black. To obtain an absolute resist the black should be allowed to develop overnight.

The resist should be printed at a temperature of about 40° C., and to ensure this a special steam-jacketed colour-box is employed.

The goods are dried stretched over frames, as being the cheapest and quickest method.

The method is particularly applicable where a number of small orders for different coloured resists on the garnet ground are received.

The pieces are printed separately and padded in the β-naphthol, and developed all together.

The process is an outcome of a similar one in use for Aniline Black printing.—J. A. P.

Indigo-dyed Goods, How to Prevent "Rubbing-off" of. Leipziger Färber- u. Zeugdr.-Zeit. **48**, [10], 417—419.

With regard to the complaints which have been made recently about the "rubbing-off" of Indigo-dyed cheviots, the author remarks that in the case of goods dyed with Indigo only, it is almost impossible to prevent "rubbing-off." In place of Indigo, he suggests the use of Alizarin Blue, which does not rub off, and is quite as fast to wear as Indigo.

However, where the use of Indigo is expressly stipulated, the following means must be adopted in order to obtain goods which do not "rub-off," or, at the most, only very slightly.

The loose wool from which the goods are made, must be thoroughly cleansed from yolk and fatty matter. For this purpose, wool which has been stored for some time is preferable to fresh undried wool. Further, the goods themselves must be well washed before dyeing and to this end, a treatment with strong fuller's earth after the usual scouring with soap, is specially recommended. The prevalent idea that light goods are more easily cleaned than heavy goods is questioned by the author, since the latter are subjected to a longer and more powerful treatment with soap and alkali, and, in addition, undergo a steaming and washing process; accordingly, before dyeing light goods, *e.g.*, cheviots, the author recommends an immersion for three or four hours in boiling water, followed by a thorough rinsing with water and fuller's earth.

Secondly, the Indigo-vat liquors must not be too old nor too thick; a fresh or comparatively fresh vat gives dyes which are faster to rubbing than those obtained from an older vat. Again, a well-limed vat is better than one which is insufficiently limed.

In this connection artificial Indigo is mentioned as being slightly faster to "rubbing-off" than the natural product, but the difference is inconsiderable.

Care must be exercised in washing the goods after dyeing. Usually it is sufficient to run them for one or two hours through a mixture of fuller's earth and urine, and afterwards rinse with water, the operations being repeated as often as is necessary.

A more effective method is to wash with water previous to treatment with fuller's earth.

If, however, this washing be insufficient, due probably to the presence of fatty matter in the goods or to the use of too thick vats, the goods must be washed first with water, then with water soured with hydrochloric acid, for 20 or 30 minutes, again with water, and finally with fuller's earth solution.

Another effective method consists in running the goods for 30 minutes through the washing machine which has been half filled with warm water (40° C.), and a decoction of myrobalans (12—15 grms. for every 50 kilos. of goods) rinsing with water, and washing well with fuller's earth. —J. E. H.

Chromic Acid, Regeneration of [Electrolytically], from Solutions containing Chromic Salts. Zeits. Elektrochem, 1899, **6**, [17], 256.

See under VII., *page* 1124.

Hyposulphurous [Hydrosulphurous] Acid, Constitution of. A. Nabl. Monatsh. Chem. 1899, **20**, 679.

See under VII., *page* 1123.

PATENTS.

Mercerising Woven Fabrics, Apparatus for. J. H. Wood, Newton Heath. Eng. Pat. 24,784, Nov. 24, 1898.

Two rectangular tanks are placed together end to end, with squeezing rollers between them. A pair of endless travelling chains, furnished with clips or pins as in a stentering machine, and passing round pulleys at each end, is placed in each tank. The first tank is filled with the "mercerising solution," through which the tissue to be treated is passed in a stretched condition. The tissue is then squeezed and passed in similar manner through the second tank which contains water.—E. B.

Dyeing, Bleaching, or otherwise treating Cops of Yarn, and Apparatus therefor. J. Major and J. Wood, Eccles. Eng. Pat. 25,525 Dec. 3, 1898.

Yarns are wound in the form of cops, upon perforated tubes which are attached to hollow, vertically-placed spindles. Dye liquors, &c., are conveyed through these to the cops while the spindles, &c., are rapidly revolved. The liquors are thus driven by centrifugal force through the yarns, their passage being facilitated by the opening out of the threads. A tank is fixed below the cops, which is exhausted before the admission of the liquors and again when the cops are being dried, an operation which is effected by means of a current of air. In a modification of the apparatus, the passage of the liquors is produced by means of a small fan placed inside the cop-tubes.—E. B.

Dyeing Textile Fabrics in Hanks or Skeins, Machinery for. P. Villette, Lille, France. Eng. Pat. 25,780, Dec. 7, 1898.

An invention relating to mechanism for alternately revolving and alternately moving to and fro in dyebaths, rods around which hanks of yarn are placed.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Nitric Acid, Manufacture of, by Distillation in Vacuo. Bergmann. Zeits. angew. Chem. 1899, 1003—1005.

This is a description of Valentiner's patented process. The apparatus consists of a cast-iron still which is completely surrounded by the hot gases of the fire used for heating it. This makes it unnecessary to protect the cast iron by earthenware, as there is no condensation of nitric acid upon the warm surfaces of the iron.

The bomb is closed by an earthenware cap (in which are glass windows) immediately followed by an earthenware receptacle which retains any small amount of matter which may froth over from the distilling vessel.

The manufacture is begun by putting into the bomb from 800—1,200 kilos. of Chile saltpetre, according to the size of the apparatus; a vacuum is then established throughout the whole apparatus by a pump, after which the quantity of sulphuric acid of 60° B. requisite for the decomposition of the saltpetre is run into the still. An evolution of gases at once takes place. These gases come from impurities in the saltpetre, and consist chiefly of nitrous acid, and of nitrosyl chloride, which is formed by interaction of nitric acid with the sodium chloride present in the saltpetre. When this evolution of gases begins to cease, firing is commenced, and the distillation of the nitric acid starts at about 85°. The temperature is controlled by a long thermometer passing into the still. The vacuum is kept at about 60 to 65 cm. of mercury and is observed by a gauge attached also to the bomb. The distillation takes from seven to eight hours to complete, and the temperature rises to 160°—170°. The sodium bisulphate remaining is run out of the still in a molten state into moulds.

The gases given off during the distillation, pass from the still and the earthenware receptacle already described, through an earthenware cooling worm (Plath's patent) which stands in a wooden cask cooled by water, and in passing through this worm, the nitric acid condenses, and is collected in one of two receivers, which, by means of a three-way tap, are so connected with the apparatus that either can be filled or emptied without interrupting the process. In this way the acid may be also collected fractionally. The nitric acid recovered is almost quite pure, and it is free from nitrous acid and chlorine, since neither of these gases is absorbed by warm nitric acid *in vacuo*. The gaseous impurities pass from the receiver through a second small earthenware cooling worm, where small quantities of nitric acid are recovered, and then through a series of absorption vessels containing milk of lime which has been found to act as an excellent absorbent for the uncondensed acid gases. The chief difficulties connected with the process are due to these gaseous impurities *viz.*, nitrous acid, chlorine, and nitrosyl chloride. They exert, if not absorbed, a highly corrosive action upon the metallic parts of the air pump, and moreover attack lubricating oil violently with production of flame and formation of hard carbonaceous masses. The adoption of the milk of lime absorbers, and of phosphor bronze injector pumps, the injector water having a little milk of lime added to it, has entirely succeeded in removing the difficulties caused by the uncondensed gaseous impurities.

The costs of the process are low. Three charges of 800 kilos. of saltpetre per 24 hours can easily be worked, with a consumption of 250 kilos. of coal per charge. The recovered acid is very concentrated and pure, and the yield is from 98 to 99 per cent. of the theoretical.—H. S. P.

Hydrochloric Acid Gas, Action of, upon Sulphates, Selenates, Tellurates, and Phosphates. R. W. Tunnell and E. F. Smith. J. Amer. Chem. Soc. 1899, **21**, [10], 929—932.

On passing dry hydrogen chloride over pure, dry potassium sulphate in the cold, it was found that about 12 per cent. by weight of the gas was absorbed, an addition-product being formed, for it maintained its composition after heating to 130° C. However, at 200° C. to a dull red heat, the HCl expelled sulphuric acid to the extent of 19 per cent. (See also Ber. 1876, 1671.)

The author attributes the expulsion of sulphuric acid from its stable salts by hydrochloric acid gas to the influence of mass action. In the presence of a selenate or tellurate, this expulsion is more complete, amounting in some cases to as much as 75 per cent. of the total quantity.

It has been established that phosphoric acid is not thus expelled from its salts by gaseous haloid acids, and the author shows that this property may be employed for the separation of phosphates from tellurates and selenates. Thus, in a typical experiment, a mixture of dry sodium tellurate and dry sodium pyrophosphate was exposed to the action of hydrochloric acid gas, care being taken that the temperature did not rise sufficiently to fuse the mass in the boat, and so cause reduction of the telluric acid. The residual phosphate was found to be quite free from tellurium, and contained the theoretical amount of phosphorus.

In the case of sodium selenate, much less time was required to effect the volatilisation of the selenic acid.. The temperature was gradually raised to 450° C., and not allowed to exceed that point. The amount of phosphorus recovered was as satisfactory as in the previous experiment.

—C. A. M.

Alkali Chlorides, Apparatus for Electrolysis of. Michel, Wilhem and Richard. Rev. Prod. Chim. **2**, [21], 323—324.

A rectangular covered vat, preferably of slate, is divided by a central slate partition, dipping into a mercury trough at the bottom and extending nearly up to the top. A flexible endless band, preferably of closely-woven wire cloth, mounted on rollers, surrounds the partition. The one compartment being charged with the chloride to be treated and the other with dilute caustic soda, the carbon anode is immersed in the former and the iron cathode in the dilute alkali. On now setting the endless metallic band in motion, it carries with it a thin coating of mercury, which, in the chloride compartment, acts as a cathode and forms an amalgam with the sodium, which it carries over into the second compartment (where it acts as the anode) and parts with it there as hydroxide. The operation is continuous and there is no risk of diffusion between the two liquids. Moreover, by immersing a second partition to the depth of a few cm. in the liquid of the first compartment, the disengaged chlorine and hydrogen can be kept apart and removed separately through suitable openings in the cover.—C. S.

Hyposulphurous [Hydrosulphurous] Acid, Constitution of. A. Nabl. Monatsh. Chem. 1899, **20**, 679.

Pure zinc hyposulphite (hydrosulphite) may be prepared in the following manner:—A flask is filled with granulated zinc and absolute alcohol which has been repeatedly distilled over metallic sodium; all air is excluded, and a current of sulphur dioxide, well dried with sulphuric acid is introduced, while the vessel is kept thoroughly cool. When the liquid is saturated, a cork is inserted, and the flask is allowed to rest; in half an hour a white precipitate begins to separate. The treatment with gas is repeated several times at intervals of one day; and the deposit is finally filtered off. The filtrate then gives a woolly precipitate, which, under the microscope, appears as long, needle-shaped crystals, belonging to the rhombic system.

Assuming that the spirit acts merely as a solvent, and that its molecule is not broken up, the hyposulphite molecule must evidently contain no hydrogen; and in view of the fact that even on standing no deposition of free sulphur occurs, zinc hyposulphite must be formed by the direct union of zinc with one or more molecules of sulphur dioxide; propositions which are borne out by Carius' formula for the compound—ZnS_2O_4. Bernthsen has already shown that zinc hyposulphite is produced in aqueous solution; the author's experiments prove that it is quantitatively formed in alcoholic solution, the alcohol acting merely as a solvent.

—F. H. L.

Lime, Phenomena in Slaking. Rohland. Thonind. Zeit. **23**, [25], 321—322.

Like calcium chloride, strong acids accelerate the combination of quick lime with water, normal hydrochloric acid producing about the same effect as a 6 per cent. solution of the above-named salt. The heat evolved (193—194 cal.) is in part due to the reaction of the acid with calcium oxide, and tends to shorten the time required for slacking. An exception is afforded by boric acid, which, when added to the slaking water in the proportion of 1 mol. per 1,000 c.c., retards the operation.

Whilst the action of water is accelerated by heat, as in other reactions, owing to the greater mobility of the molecules, the behaviour of the salts and acids referred to in this particular instance, may be regarded as a case of catalytic action.—C. S.

Quicklime, Estimating the Specific Gravity of. Kosmann. Thonind. Zeit. **23**, [31], 413—414.

To overcome the difficulties presented by the porous nature of the substance, the author impregnates the test samples with melted paraffin over the water-bath, and determines the sp. gr. after they have been carefully drained. To obtain correct results, it is necessary to first ascertain the weight and volume of paraffin absorbed.

With a sample of quicklime from Silesian marble, weighing 73 grms., the amount of paraffin (sp. gr. 0·822) absorbed was 17·80 grms., and the weight of water displaced by the treated sample, 50·80 grms. The volume occupied by the paraffin $= \frac{17 \cdot 8}{0 \cdot 822} = 21 \cdot 65$ c.c., and consequently the weight of water actually displaced by the lime was 29·15 grms., the apparent sp. gr. being therefore 1·43, and the real sp. gr. of the lime 2·5, the total volume occupied by the pores in the sample being 42·6 per cent. The weight per cubic metre of the slaked lime was determined as 1,451 kilos. for the formula $CaO, 5 \cdot 5\ H_2O$, and 1,467 kilos. for $CaO, 8H_2O$.

Corresponding tests with other classes of lime gave the following values:—*Elbingerode lime:* apparent sp. gr. 1·882; actual sp. gr. 3·11; weight per cubic metre of slaked lime ($CaO, 8H_2O$), 1,501 kilos. *Salzhemmendorf lime:* apparent sp. gr. 1·568; real, 3·22; weight per cubic metre of slaked lime ($CaO, 8 \cdot 08\ H_2O$), 1,492 kilos. *Bredenbeck (coralline) lime:* apparent sp. gr. 1·41; real, 2·848; weight per cubic metre of slaked lime ($CaO, 8 \cdot 1\ H_2O$), 1,487 kilos.—C. S.

Chromic Acid, Regeneration of, from Solutions containing Chromic Salts. Farbwerke vorm. Meister, Lucius und Bruning. Ger. Pat. 103,860, June 12, 1898. From Zeits. für Elektrochem. 1899, **6**, [17], 256—257.

The solution of the chromic salt, *e.g.*, chromium sulphate, is mixed with sulphuric acid to produce a solution of maximum electrical conductivity (100 grms. of Cr_2O_3 to 350 grms. of H_2SO_4 per litre) and electrolysed in a lead-lined cell divided into two compartments by a diaphragm. Lead plates are employed as electrodes. Chromic acid is formed in the anode compartment, whilst hydrogen is evolved at the cathode; at the same time the concentration of the sulphuric acid increases in the anode division and decreases in the other.

The liquor from the anode chamber is utilised for oxidising purposes, and then returned to the cathode chamber, the liquid from this chamber having been previously transferred to the anode compartment. At the beginning of the second operation, the liquid surrounding the cathode is richer in sulphuric acid, but this gradually migrates towards the anode as oxidation proceeds.

In this way a cycle of operations is procured without the accumulation of sulphuric acid at any stage. The composition of the liquid, which is employed alternately in the cathode and anode compartment, is thus maintained unaltered, and it can consequently be used for an indefinite number of times as an oxygen carrier.

With a current density of over 300 ampères per square metre, the electromotive force rarely exceeds 3·5 volts at about 50° C.—J. S.

Dicarbonyl Cuprous Chloride. W. A. Jones. Amer. Chem. J. 1899, **22**, [4], 287—311.

Berthelot, in 1856 (Ann. Chim. Phys. **46**, [3], 488), succeeded in isolating the compound formed by passing carbon monoxide through a cold saturated solution of cuprous chloride in concentrated hydrochloric acid. He believed the compound to be of the composition $Cu_2Cl_2.CO.2H_2O$, but his evidence was very unsatisfactory.

The author made experiments to determine more accurately, if possible, the composition of the substance, its properties, and the chemical activity of the carbon monoxide at the moment of its liberation. He found that carbon monoxide is not absorbed by dry cuprous chloride, but is absorbed by that substance when in hydrochloric acid solution or suspended in water. The result of the absorption is the formation of a compound of definite composition, corresponding to the formula $Cu_2Cl_2.2CO.4H_2O$. The compound behaves like other inorganic compounds containing carbon monoxide; it is decomposed by reduction of pressure or elevation of temperature. The carbon monoxide shows no marked increase of chemical activity at the moment of liberation from the compound. The author considers that the substance deserves to be ranked as a true chemical compound.—A. S.

Orthoplumbates of the Alkaline Earths, Observations on: A New Grade of Oxidation of Lead. G. Kassner. Arch. Pharm. 1899, **237**, 409; through Chem. Zeit. Rep. 1899, **23**, [29], 281.

The author found the formula for calcium-meta-plumbate, prepared according to Grutzner and Hohnel by a wet process, to be $CaPbO_3 + 4H_2O$. It loses three-fourths of its water at a temperature of 300° C., but the last fourth only at a still higher temperature. When treated for some time with a current of air at 200°—280° C., a higher grade of oxidation of the lead is reached, probably in combination with lime. This higher oxide shows the nature of a peroxide proper and the character of an acid (perplumbic or hyperplumbic acid), the salts of which would have to be called "perplumbates." The Pb_2O_5 derived from it would be the lead pentoxide or the lead peroxide, whilst the substance PbO_2, commonly called lead peroxide, should be termed lead dioxide, since it does not possess the character of a true peroxide.—S. K.

Nitrogen Dioxide, Determination of. G. von Knorre and K. Arndt. Ber. **32**, [13], 2136.

See under XXIII., *page* 1156.

PATENTS.

Sulphuric Acid, Apparatus for Use in the Concentration of. J. W. Fisher, J. A. Hall, and F. Moore, Victoria, British Columbia. Eng. Pat. 27,376, Dec. 28, 1898.

Sulphuric acid, of not lower sp. gr. than 1·70, is run continuously into a cast-iron pipe, of about 10½ ft. long, 1 ft. in diameter, and from ¾ to 1 in. thick, or of similar proportional dimensions, the outlet pipe leading to a cast-iron settling box, the overflow from which is conducted to a cooler. A pair of such pipes is shown, set horizontally in a furnace, so that the acid is kept continuously boiling, as it flows. Each pipe is provided with inlet and outlet, the outlet pipe passing to the condenser being of a somewhat larger diameter than the inlet pipe. It is stated that "a distillate of a specific gravity of about 1·45 corresponds to a strength of concentrated acid of from 95 to 97 per cent., using a feed acid of a specific gravity of 1·73." The outlet pipe for the concentrated acid passes below the surface of the acid in the settling box, thus forming a lute. Claims are made for the construction of the end pieces having inlets and outlets cast thereon; and for the inlet and outlet connections having means for attachment so arranged as to allow of the turning of the pipe or pipes, an elbow being provided for connection to the vapour-outlet pipe.—E. S.

Sulphur Trioxide (Sulphuric Anhydride), Manufacture of. O. Imray, London. From The Farbwerke vormals Meister, Lucius und Brüning, Hoechst-am-Main, Germany. Eng. Pat. 285, Jan. 5, 1899.

The invention consists in the manufacture of sulphuric anhydride by the contact process, in regulating the temperature in the contact chamber by mixing the reaction gases therein with cold gases.

The gases containing SO_2, previously heated to the reaction temperature, enter the contact chamber. On passing through the contact body, the oxidation of the SO_2 into SO_3 causes rise of temperature, which is compensated by admission of cold SO_2 through a pipe controlled by a valve. The action is watched by means of a heat indicator. The same process is repeated in each next higher compartment, the temperature being throughout maintained so as to be most favourable to the reaction, and also provide "that the gases leaving the contact chamber are of a sufficiently high temperature to be utilised for heating the SO_2 gases entering the contact chamber."—E. S.

Bichromate of Soda, The Production or Treatment of. A. Goldschmidt, Bockum-Krefeld, Germany. Eng. Pat. 25,020, Nov. 26, 1898.

Sodium bichromate is obtained free from sodium sulphate by concentrating the mono-chromate solution, obtained in the usual way (by leaching the chrome-smelting or roasted material), to the consistency of a paste, and adding strong sulphuric acid in proportion to form a bichromate of soda lye of sp. gr. 1·795, in which sodium sulphate is stated to be quite insoluble. The hot liquid is filtered from the precipitated sulphate, and dried. Bichromate lye containing sulphate, or impure sodium bichromate, may, in like manner, be freed from sodium sulphate.—E. S.

Nitrogen Compounds, Manufacture of. A. Frank, Charlottenburg, and Dr. N. Caro, Berlin. Eng. Pat. 25,475, Dec. 2, 1898.

Cyanides are produced by causing nitrogen to act at about 700° C. on a carbide, or carbide-forming mixture, such as a mixture of carbon with oxides of alkaline-earth metals or alkali metals. For example, barium carbide is heated in a muffle through which dry nitrogen, or the vapour of "a liquid or solid nitrogeniferous substance," is led, until the gas ceases to be absorbed. Part of the nitrogen taken up forms cyanamide, paracyanogen, and other nitrogen compounds. These are converted into cyanide by melting the reacting mass with a suitable flux, such as soda or potash, sometimes with addition of carbon. From masses containing cyanamide (or amidocyanide) this product may be obtained by exhausting the material with water, expelling hydrocyanic acid by carbonic acid, and collecting the cyanamide by agitation with ether or other suitable solvent. —E. S.

Evaporating and Concentrating Liquid Solutions [Caustic Soda, &c.], and in obtaining Solid Substances from such Solutions, Means for. W. Mather, Manchester. Eng. Pat. 26,981, Dec. 21, 1898.

The solution to be treated is delivered into a heated bath, in which revolves an internally heated cylinder. When the desired concentration is reached, the film of the concentrated solution on the heated cylinder is transferred to a cold cylinder, on which it solidifies, and is removed therefrom by a "doctor" or like blade. The cold cylinder is kept cool by a continuous stream of water through it. A series of such baths and heating cylinders may be employed, and the liquid passed from one to the other throughout the series, the concentrated solution being removed by the cold cylinder from the last heated cylinder.—R. A.

Ammonia and its Salts, A Process of and Apparatus for obtaining, from the Spent Liquor of Molasses in Sugar Factories and from Vinasse. H. Fischer, Pecek, Bohemia. Eng. Pat. 15,815, Aug. 2, 1899.

See under XVI., *page* 1142.

VIII.—GLASS, POTTERY, ENAMELS.

Glass Making in the United States. R. Linton. Eng. and Mining J. 1899, **68**, [16], 454.

Glassware may be divided into three varieties according to the method of working the "metal" or molten glass :—

(1.) *Blown Glass.*—Window glass, all kinds of bottles, flasks, carboys, fruit jars, tumblers, lamp chimneys, globes, chemical apparatus, &c.

(2.) *Pressed Glass.*—Table ware and many kinds of novelties. The lump of molten glass is withdrawn on the end of a rod, dropped into a mould, and pressed out by a plunger into the shape desired.

(3.) *Cast Glass.*—Polished plate glass, rough and ribbed skylight glass, cathedral glass, wire glass. The molten glass is poured or ladled from pots on to a metal table and rolled into sheets with a metal roller.

The limestone used in glass manufacture should be tested from time to time for magnesia, this impurity being of frequent, though irregular, occurrence, and when present in any considerable quantity, being very troublesome. The use of sulphate of soda is rapidly extending, especially for window glass, and it is said to be preferable to the carbonate for tank furnace melting, giving a clearer and more homogeneous glass.

For melting, gaseous fuel is now almost exclusively used, whilst for blow furnaces, "glory holes," flattening ovens, "lehrs," &c., oil fuel has been successfully applied, the oil being injected into the burners either by the use of a steam jet or by compressed air.

Since 1890 marked progress has been made, notably in machines for blowing fruit jars, lamp chimneys, &c.; improved annealing apparatus, mixing machinery, and automatic weighing apparatus; and displacement of the old pot furnaces by continuous tank furnaces.

Figures are given showing that the imports of plate and window glass into America have greatly decreased during the past 10 years.—A. S.

Stoneware, Peeling of Glaze from the edges of. T. S. Sprechsaal. **32**, [35], 1087—1088; [36], 1115—1118.

Two principal causes contribute to this defect: the use of glaze with a coefficient of expansion differing considerably from that of the stoneware body, and the formation, at the edges of the ware during drying, of an efflorescent layer of salts, chiefly calcium sulphate, from the water used in softening and working the body.

The remedy in the first-named case is obvious. The other cause may be removed by rubbing the edges of the biscuit ware with pumice stone, or, this being an expensive operation, brushing the edges with red lead held in suspension in water. This again requires care, since an excess of red lead will cause the edges to turn yellow when fired, and also increases the tendency of the glaze to craze. A more efficacious means of prevention consists in decomposing the calcium sulphate by adding barium carbonate or barium chloride to the wet body, the actual small percentage necessary for this purpose being determined by experiment. —C. S.

Tiles, Stoneware; Manufacture of. M. B. Sprechsaal. **32**, [39], 1203—1204; [40], 1231—1232.

For coloured tiles the following recipes are given :—

Blue.—The colouring matter is composed of cobalt oxide, 2 parts; quartz, 30; zinc oxide, 14; kaolin, 54 parts; ground together and calcined: one part of this product being incorporated in the mill with 10 parts of white stoneware body.

Green is obtained with chromic oxide, toned with blue body, or by a mixture of blue and yellow bodies. A *light green* is furnished by: potassium bichromate, 38 parts; chalk, calcspar, or marble, 32; quartz, 18; fluorspar, 12 parts; calcined, thoroughly washed, and calcined again.

Red is obtained from "*Rouge de Thiviers*" or the following mixture: tin oxide, 57 parts; chalk, 25; quartz, 15; potassium bichromate, 3 parts, well mixed, calcined, thoroughly washed and re-calcined.

Red-burning clays furnish *brown* to *rose-red*; yellow-burning clay, or rutile and white clay, producing *yellow* bodies—the yellow underglaze colours are very uncertain and should be avoided. *Grey* is obtained by an addition of chrome ironstone or a little blue body.

Black tiles are best prepared from dark red clay body glazed with dark blue glaze, *e.g.*, plastic clay, 25 parts; red clay, 35; quartz, 35; felspar, 5 parts; *blue fritt*:—quartz, 26 parts; kaolin, 11; minium, 13; chalk, 15; borax, 19; cobalt oxide, 16 parts; *white fritt*:—quartz, 20 parts; felspar, 12; kaolin, 27; minium, 19; chalk, 7; borax, 15 parts. These fritts are mixed and milled in the following proportions: blue fritt, 34 parts; white fritt, 50; white lead, 10; felspar, 6 parts.

The coloured bodies can also be employed for facing white-body tiles at less cost than if used alone; for this purpose the coefficient of shrinkage must be determined and corrected to agree with that of the white mass. Common white body can also be covered with a superficial layer of better materials.

Extreme care is necessary in glazing, since glaze with an unsuitable coefficient of expansion is certain to "craze," and chip at the edges. This last named defect can be rectified by increasing the proportion of flux, whilst an addition of quartz or boric acid will prevent crazing.

Owing to irregularities in the biscuit oven the tiles may be unequally baked, in which event the over-baked ones will allow the glaze to chip at the edges, whilst those insufficiently baked will craze; the former—distinguishable by the greater shrinkage—should be treated with special glaze, and the others should be re-baked before glazing.

The glaze should be applied by dipping the face of the tiles only, and the glazed tiles should be fired in pairs, face to face, in rectangular "saggars."

The essential uniformity of colour can only be secured by sorting out such tiles as have been equally baked in the biscuit oven, and by maintaining a uniform atmosphere in the finishing kiln. In white tiles the colour can be regulated by employing a glaze containing 7—10 per cent. of zinc oxide, which masks the surface.

Decorative patterns are applied by underglaze printing or by stenciling, as well as by means of inlaid glazes put on with the brush, inlaid colours being covered with opaque enamel glaze.

Should the tiles crack in the biscuit oven, an excess of moisture, quartz, or clay, is indicated, and the same result may occur if the quartz has been ground too fine. The same tendency is intensified in the finishing kiln, but may be counteracted by protracted cooling. Glaze liable to chip at the edges will also assist cracking in the finishing kiln.—C. S.

PATENTS.

Glass Manufacture and other Purposes, Furnaces for. C. Kilner, York. Eng. Pat. 6204, March 22, 1899.

In operating glass melting tank furnaces, it is found that under certain conditions the heated air and gases flow outwards through the working holes. The object of this invention is to drive the gases back by means of a blast of air or steam directed into the furnace through the holes. Such air blast may also be used for reducing the temperature when the furnace is working too hot.—H. H. B. S.

Enamelling or Treating Steel and Homogeneous Iron for the Manufacture of Goods to be Enamelled, and of Producing Enamelled Goods or Ware. A. M. Clark, Middlesex. From "The National Enamelling and Stamping Co.," New York, U.S.A. Eng. Pat. 10,790, May 23, 1899.

See under X., page 1130.

Glass and the like for the Production of Designs thereon by Etching, Preparing. L. Kiesel and F. Watzina, both of Essen, Germany. Eng. Pat. 18,342, Sept. 11, 1899.

The design to be etched is printed upon transfer paper, and the impression, while moist, dusted over with powdered resin or other protective material, which adheres only to the parts printed upon. The protective material is then melted on by the application of a moderate heat, after which the paper is applied to the glass. The transfer is effected by rolling the paper with a heated roller, or the design may be sprayed with a suitable solvent before it is pressed on the glass. In either case the paper is finally removed by moistening with water, leaving the design adhering to the glass, which is then treated with the etching fluid in the usual way.—H. H. B. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clays, Preparatory Examination of. W. Cronquist. Chem. Zeit. Rep. 1899, [33], 322.

The examination of clay as to its suitability for bricks must be both chemical and mechanical. In the Stockholm Geological Bureau the following processes are employed:—An air-dried sample is boiled with hydrochloric acid of not less than 1·12 sp. gr. until the undissolved sand is white. After filtering, the residue of sand and gelatinous silica is boiled with sodium carbonate solution in a silver dish, the residue is filtered off, washed, ignited, and weighed. It is then examined for other minerals, *e.g.* mica, which causes weak bricks. The Swedish clays contain 47—72 per cent. of sand, but are all used for brick-making. The anhydrous silicates contain 37—45 per cent. of silica, but the proportion gives no indication of the value of the clay, except as to its fire-resisting qualities. The author endeavours to supplement the inadequacy of the analytical by two practical methods. Since it is not easy to get an average sample from the clay at its various stages of manufacture, it is recommended to take a boring at each meter depth, and to unite the dried powdered samples. To ascertain the shrinkage the kneaded mass is pressed into a wooden mould 20 × 4 × 1 c.m. Upon the plate a line exactly 150 mm. long is drawn. Warping can be easily observed. A shrinkage of 8 per cent. during drying indicates a good binding clay. In order to examine the strength of the clay, crucibles are moulded 45 mm. high and 2·5 mm. thick, these are dried 4—6 days at the ordinary temperature, then 2 days at 100° C., and burnt together with crucibles of a standard clay. The strength of the crucible is then determined in a special apparatus, in which it is broken by lead blocks.

—A. C. W.

Cement, The Effect of Salt Water on. A. S. Cooper. Jour. Franklin Inst. **148**, [4], 1899, 291—302.

Briquettes were made with mortars composed of various proportions of cement and sand, some of the mortars being gauged with sea water and some with fresh. The briquettes were first laid in moist air for 24 hours, and then some of each were immersed in tanks of sea water and fresh water respectively. In each set of experiments, briquettes similarly prepared and treated were submitted to tension and compression tests at the end of 7 and 28 days, and 3, 6, and 12 months. The advantage, in the short time tests, was on the side of the salt water briquettes, but as time progressed, this advantage was lost, and eventually the fresh water briquettes proved the stronger. As regards the effects of sea water upon concrete, the experiments were not sufficiently protracted to form a decided opinion, but the indications obtained pointed to a weakening action. Experiments with different descriptions of sand led to the conclusion that rough sand, like that obtained by crushing trap rock, produced briquettes of superior strength, but that with perfect ramming, the actual size of the grains was of less consequence than the condition of their surfaces.

A supplementary set of experiments was also made to study the effect of allowing Portland cement mortar to stand for certain lengths of time before being used. Practically no injury was sustained by the mortar on standing for 8½ hours, and it is stated that even 12 hours' standing does no harm if the mortar is kept wet.—H. H. B. S.

Cement Mortar, Influence of Water containing Carbon dioxide on. W. Michaëlis. Thonind. Zeit. **23**, [45] 660.

The author corrects the erroneous statement that he had recommended the addition of trass to cement mortar as a protective agent against the action of water containing carbon dioxide, and points out that what he advised was the employment of puzzuolana to preserve cement in presence of the sulphuric acid compounds in sea water. The sole means of attaining the first-named object is to render the surface layers of the mortar waterproof, and convert the lime therein into calcium fluoride, or by applying a waterproof coating unattackable by dissolved carbon dioxide and by the alkali oxides in the mortar. To enable this to be done it is essential that the mortar should be perfectly dry and fairly porous, but not excessively so, or waterproofing will be impossible.—C. S.

Portland Cement Manufacturers, Proceedings of the Soc. of German. Zeit. angew. Chem. 1899, [43], 1042—1043.

An account was given by Michaëlis of the results of an enquiry into the subject of the combination of hydraulic materials with water. Finely ground Portland and other hydraulic cements, on being shaken up with a large excess of water until sufficiently hydrated, acquire a flocky, voluminous condition, and eventually form stiff jellies.

This colloidal condition affords protection against the injurious effects of the salts of sea water. The property is found in the highest degree in good Roman cement, but the fluctuating quality of this cement is against its employment for marine work. More reliable results are obtained with a combination of Portland cement and puzzolana or desulphurised granulated slag.

The principal ingredient—lime hydrosilicate—has not, so far, been produced by any method of crystallisation in the cold. A crystalline lime hydrosilicate of the formula CaO, SiO_2, H_2O has certainly been prepared, but under quite different circumstances, *viz.*, by fusion with caustic potash, and this seems the more remarkable, inasmuch as this body loses four-fifths of its water at 100° C. and the remainder below a red heat. Silica dissolves in fusing caustic potash to hydrate, and at this temperature possesses a considerable affinity for lime, so that it must be assumed that this body exists as hydrate in fusing caustic alkali, although it cannot of itself exist as hydrate at this temperature. An analogy is shown in the hydration of silica at a high temperature in the presence of moisture.—H. H. B. S.

Portland Cement, Testing Regulations for, in Holland.

Thonind. Zeit. **23**, [30], 394.

When passed through a sieve with 900 meshes per sq. cm. the cement should not leave more than 10 per cent. of residue. Setting should take at least two hours. The test is performed in an ebonite ring, 40 mm. high, with mortar of normal consistency, *i.e.*, so stiff that a 300 grm. steel rod of 1 sq. cm. sectional area will penetrate the freshly prepared mass (in the ring) to within 6 mm. of the bottom. Setting is considered to commence when the testing needle—1·2 mm. diameter, and weighted with 300 grms.—will not penetrate quite through the mass; and as ended when the needle will no longer make any impression.

Constancy of volume:—A cake of the cement placed on glass and protected from drying for 24 hours, should not crack or change in shape in the air or under water, even after prolonged storage.

Tensile strength:—The test blocks—octagonal blocks of 5 sq. cm. minimum section, and compression cubes of 5 sq. cm. side—are prepared from 1 part by weight of cement, 1 part of normal sand, and 0·3—0·4 part of water. After exposure to moist air for 24 hours, and 27 days' storage in water at 15° C., they must exhibit a breaking strain of at least 16 kilos. per sq. cm. and a compression strength of at least 160 kilos. per sq. cm. In case the test is performed after six days, the above minimum standards are reduced to 10 and 100 kilos. respectively. For pure cement, without mortar, the minimum breaking strain for a six day test is 25 kilos., and for a 27th day test 35 kilos. The mean of the six highest values out of 10 tests shall be taken as the breaking strain, and the mean of the three highest out of five tests as the compression strength.—C. S.

Portland Cement, Chemistry of. F. Hart.

Thonind. Zeit. **23**, [45], 659—660.

The question whether the lime in Portland cement clinker is in the free state or combined with silica, alumina, or iron oxide was inquired into, and the author proposes to employ for the purpose a 10 per cent. alcoholic solution of iodine, since this reagent forms soluble iodides with all the bases present in cement, free lime in particular becoming quantitatively converted into calcium iodide.

The test is performed by dissolving 10 grms. of iodine in about 75 c.c. of absolute alcohol, by warmth and agitation. One grm. of the cement (passed through a sieve with 5,000 meshes per sq. cm.) is added to the solution, which is then made up to 100 c.c. and stored for four weeks in a loosely corked flask expcsed to diffuse daylight, the contents being stirred daily. It is then passed through a double filter, moistened with alcohol, and washed with absolute alcohol until the washings are colourless and cease to precipitate silver nitrate solution. The filtrate is warmed until all the alcohol and free iodine have been driven off, and, after repeated addition of concentrated hydrochloric acid and evaporations, is tested in the usual manner for CaO, R_2O_3, and SiO_2.

The residue on the filter is weighed, treated with water and dilute hydrochloric acid, gently warmed, and also tested for the same oxides.

The results obtained by the author show that 30 per cent. of CaO, 0·45 per cent. of R_2O_3, and 1·8 per cent. of SiO_2 were present in the solution; whereas the residue which, in presence of dilute hydrochloric acid, became gelatinous in a few hours—like Portland cement—contained 21·4 per cent. of SiO_2, 8·8 per cent. of R_2O_3, and the balance of the lime originally present. The conclusion is that the cement in question contained about 30 per cent. of free lime.—C. S.

Bricks of Lime and Sand, Method of making. P. Kleber.

Thonind. Zeit. **23**, [45], 660—661.

The claim on which this method—forming the subject of Ger. Pat. 103,777—is based, is for slaking a mixture of quicklime, sand, &c. with 5—10 per cent. of dilute hydrochloric acid, and hardening the moulded mass with superheated steam under pressure.

To carry out this idea the pulverised quicklime, mixed with about 15 parts of sand or other filling material, is incorporated with 5—10 per cent. of dilute hydrochloric acid—containing up to 20 per cent. of 19° B. acid—and left for about 15 minutes in a hopper leading to a second mixing machine, which hopper is preferably divided into three compartments to enable the work to be performed continuously. The mixture enters the second machine in a perfectly dry, pulverulent condition; after being there moistened sufficiently for moulding, it is conveyed to the press, on leaving which the bricks are hardened by exposure to steam pressure in a suitable chamber for three to six hours, and are then ready for sale.

The initial treatment results in the formation of a dense hydrate of imperfectly slaked lime containing only a fraction ($\frac{1}{3}$—$\frac{1}{5}$, &c.) of the amount of water required for complete hydration

The technical advantages secured by this method comprise: the acceleration of the slaking process by the use of hydrochloric acid; the production of bricks which can be hardened immediately they come from the press; the non-necessity for any drying process: the rapid formation of silicates and hardening of the product: and the possibility of turning out an article of uniform quality irrespective of climatic influences.—C. S.

Artificial Stone, Uses of Alkali Silicate (Water-Glass) in. B. H Füchten.

Keram. Rundschau, 1899, 74; Thonind. Zeit. **23**, [24], 307—308.

By reacting on the carbonates, sulphates, &c. of the alkaline earths, as well as on alumina and lead oxide, water-glass produces insoluble silicates which act as cementing material to bind the inert ingredients of artificial stone masses. These may be coloured: *black*, by up to 12 per cent. of carbon or graphite; *brown*, by manganese oxide or dark ochre (8 per cent.); *red*, by 6 per cent. of Indian red (red ochre); *brick red*, by 4—7 per cent. of cinnabar; *orange*, by 6 to 8 per cent. of minium; *yellow*, by 6 per cent. of yellow ochre or 5—7 per cent. of chrome yellow; *green*, by 8 per cent. of chrome green; *blue*, 5—10 per cent. of Neuwied or Bremen blue, Cassel blue, or Napoleon blue; *white*, by up to 20 per cent. of zinc white. Chrome green and zinc oxide give artificial malachite, and lapislazuli is imitated by means of granular pyrites and Cassel blue.

The proportions of ingredients taken vary according to the use of the stone, and whether it is to be pressed or cast in the making. Imitation *sandstone* is made from: limestone, 100 parts; 42° B. sodium silicate, 35 parts; fine quartz sand, 120—180, and medium sand, 180—250 parts. *Basalt* is imitated by means of equal parts of K_2S_5 and lead acetate, or antimony ore and iron filings; *marble*, by, *e.g.*, marble dust or levigated chalk, 100 parts; powdered glass, 20; fine, sifted limestone, 8 parts, and a corresponding amount of alkali silicate, the colouring matters being mixed with the chalk.

For casting, a mixture of 30° B. alkali silicate with: levigated chalk, 100 parts; slaked lime, 40; quicklime, 40; fine quartz sand, 200; coarsely powdered glass, 130; opal, diatomaceous earth, or the like, 80 parts (or 150 parts of fluorspar), will furnish a mass which contracts in setting.

Another mass is prepared from: hydraulic lime or cement, 50 parts; sand, 200—300 parts; and finely ground sodium silicate, 5—6 per cent, the mixture being moistened with about 10 per cent. of water and rammed into moulds.

The unwelcome efflorescence formed on the surface of artificial stone prepared from alkali silicates and consisting of liberated alkali carbonates, can be combated by incorporating amorphous silica with the mass, also by warm lixiviation, preferably with very dilute hydrochloric acid, or by steaming. Impregnation with fluosilicate preparations may also be practised for the same purpose and to increase the durability of the stone.

Alkali silicates can also be employed to harden artificial stone prepared from hydraulic mortar, but it is necessary for the mass to be thoroughly dry first. Extra hardness may be imparted by a subsequent treatment with fluosilicates. —C. S.

Marble, Artificial [*Marmorite*]. R. W. Strehlenert. Thonind. Zeit. **23,** [39], 548 and 553.

This product is manufactured in Sweden from anhydrous calcium sulphate and alum, in the form of plates 5—10 mm. thick and up to 4½ sq. m. superficial area. It is elastic, and can therefore be adapted to irregularities in the walls it is employed to face; and it is said by the makers to be unalterable by fluctuations of temperature and other climatic conditions. The author, however, points out that unless sufficient water is added, in mixing the mass, to satisfy the requirements of the $CaSO_4$ as regards crystallisation, there will be a tendency to absorb moisture and form cracks, blisters, or stains on the surface.—C. S.

Quicklime, Estimating the Specific Gravity of. Kosmann. Thonind. Zeit. **23,** [31], 413.

See under VII., *page* 1124.

Timber, Fireproofing and Preserving of. Sherard Cowper-Coles.

See page 1086.

PATENTS.

Waterproof and Acid-proof Compounds. J. H. W. Stringfellow, Hackney, Middlesex. Eng. Pat. 23,981, Nov. 14, 1898.

The compound is prepared by adding to melted pitch, shellac, bitumen, india-rubber, gutta-percha, or similar material, an equal weight of powdered glass, pumice, or other silicious substance. The materials to be treated are dipped into the melted compound. Thus, sheets of asbestos millboard so treated may be used in the construction of cisterns, tanks, &c., or wire framework may be covered with the compound, producing a material suitable for roofing and other purposes.—H. H. B. S.

Cement, Manufacture of. J. Steiger, London. Eng. Pat. 18,483, Aug. 29, 1898.

Solutions of chloride of magnesia and silicate of potash or soda are mixed together, evaporated to dryness, and powdered. Hydrosilicate of magnesia and chloride of the alkali are formed, but the proportions of the two solutions are to be so adjusted that an excess of chloride of magnesia shall be left. The powdered material is then mixed with calcined magnesia.—H. H. B. S.

Cement, Manufacture of. W. Borgolte, Höxter, Germany. Eng. Pat. 12,871, June 20, 1899.

The raw materials usually employed in the manufacture of Portland cement are burnt separately with a small proportion of a hydrocarbonaceous material, such as tar, oil, or paraffin, without access of air. The burnt materials are then broken up and mixed in suitable proportions, and the mixture again burnt with a hydrocarbonaceous material, without access of air, as before. The product is said to set with a hard, shiny surface, and to offer more than ordinary resistance to atmospheric influences. It may be used in conjunction with mineral substances, either in their natural condition or previously burnt with a hydrocarbonaceous material.—H. H. B. S.

Enamel, applicable to all Kinds of Bricks and other Articles made of Clay, Manufacturing an. E. P. C. Willems, Schelle, near Antwerp, Belgium. Eng. Pat. 15,804, Aug. 2, 1899.

The enamel is composed of the following ingredients, in about the proportions stated, *viz.*, silica, 36 parts; alumina, 10 parts; alkaline matter, 7 parts; and metallic oxides, 47 parts. The metallic oxides mentioned in the claims are those of tin, cobalt, and iron, which impart white, blue, and black colours respectively.—H. H. B. S.

Fire- and Acid-Proof Bricks, Slabs, and other Earthenware Articles or Structures. E. W. Engels, Essen-on-Ruhr, Germany. Eng. Pat. 24,378, Nov. 18, 1898.

The process is as follows:—The articles to be rendered fire- and acid-proof are covered with a mixture of quartzite or sand and coal, coke, charcoal, or graphite, which is then fused into them by means of the electric arc, producing a coating of carbide of great fire- and acid-resisting qualities. To prevent cracking, the articles are subjected to a preliminary heating before the application of the electric arc. In the case of already existing structures, the mixture, before being applied, is made up with tar or similar binding material.—H. H. B. S.

Substitute for Wood and Stone, and for the Moulding of Hollow Ware and the like, Composition applicable as a. J. A. Wheeler, Oswego, and S. W. Eells, New York, U.S.A. Eng. Pat. 10,798, May 23, 1899.

Wood-pulp, used either with or without a powdered incombustible material, such as ashes or talc, is moistened with hot water, and then silicate of soda is added. The mass is kneaded and mixed with quicklime and powdered resins or gums while in a heated state. The compound may be improved by the addition of powdered calcined magnesite soaked in chloride of magnesium or other chloride. If the material is required to be fireproof, asbestos is used in place of wood-pulp. The mixture is moulded to the desired shapes, the moulded articles baked, and finally finished by cutting or polishing.—H. H. B. S.

X.—METALLURGY.

Metals, Progress in the Chemical Analysis of. H. Weber. Zeits. anal. Chem. 1899, 663—674.

Volumetric Estimation of Gold and Platinum.—H. Peterson's iodine method (this Journal, 1899, 176) is recommended.

Estimation of Antimony.—v. Knorre's method of reduction with sodium sulphite (this Journal, 1888, 344) in acid solution, followed by titration with iodine in alkaline solution, gives good results. Accounts are given of Jolles' potassium manganate process, and of A. Baumann's process (Zeits. angew. Chem. 1892, 117), in which antimony or arsenic trioxide is oxidised in alkaline solution by means of an excess of potassium ferricyanide, and the unreduced residue of ferricyanide is determined gasometrically by treatment with hydrogen peroxide (thus:—

$$K_6Fe_2Cy_{12} + 2KOH + H_2O_2 = 2K_4FeCy_6 + 2H_2O + O_2);$$

of H. Giraud's method of estimating antimony in the presence of tin (this Journal, 1887, 226) by means of the reaction of antimony pentachloride, and the non-reaction of stannic chloride, with hydriodic acid; of A. Lecrenier's modification (this Journal, 1890, 108) of Classen and Ludwig's electrolytic method; of R. Finkener's method for determining antimony in commercial copper (this Journal, 1889, 733); of Carnot's tin precipitation method for antimony ores (this Journal, 1892, 636 and 941); and of Bošek's experiments on the action of hydrogen sulphide on antimonic acid solutions (this Journal, 1895, 513).—W. G. M.

Metals, The Colloidal Condition of. A. Lottermoser. Versammlung der Ges. Deuts. Naturforscher u. Aertzte. From Chem. Zeit. 1899, **23**, 864.

Carey Lea's colloidal silver, formed by reducing silver nitrate by ferrous sulphate in presence of an alkaline citrate, is precipitated by all electrolytes. In a quantitative examination of the conditions of precipitation, the author has found that the amounts of different acids needed to precipitate colloidal silver of given concentration are inversely proportional to their strengths. A similar relation was found by Bodländer to hold for the precipitation of suspended kaolin, so that colloidal solutions are, no doubt, suspensions of very minute solid particles. Alkali salts of those acids whose silver salts are soluble, precipitate the silver from suspension in the colloidal form; the alkali salts of other acids precipitate it as insoluble metallic silver. Reducible metallic chlorides form the metallous chloride and silver chloride; in very dilute solutions the latter remains in suspension in the colloidal form. Dissolved halogens also form from colloidal silver the colloidal halides; these are precipitated in the insoluble form by all electrolytes, but are much more stable if the solution, to begin with, contains some stable colloid like albumin or gelatin. The author has obtained colloidal mercury, bismuth, and copper, by reduction of their solutions by stannous chloride in presence of alkaline citrate, the first in acid, the others in alkaline solution. These all contain a small proportion of tin as colloidal stannic acid. Colloidal silver prepared by the author by reducing silver nitrate with stannous chloride also contains tin in this form; the author produced it synthetically by adding colloidal stannous chloride to ordinary colloidal silver. He is of opinion that this colloidal stannic acid is necessary for the stability of colloidal mercury, bismuth, and copper, behaving towards them as albumin or gelatin behaves to colloidal silver chloride.—J. T. D.

Sheet Iron, Petroleum in the Manufacture of. Eng. and Mining J. 1899, **68**, [17], 484.

Petroleum residuals have been used since 1897 in the Nytvinsk Factory of the Kamsk Company in Russia, as fuel in the manufacture of sheet iron, and it is claimed that, by this means, the difficulty of obtaining an even temperature over the rolls has been overcome. With petroleum furnaces, the heat is evenly distributed over the whole plate, whilst air is admitted in the right proportions, so that oxidation of the iron is prevented. The furnace used is very similar to the usual gas furnace. At the back of the furnace arch is an opening which admits an oil sprayer. The sprayer is free to move in any direction, but there is no possibility of air entering except through the sprayer. The products of combustion travel through side flues to the chimney, which is usually a short one, as with petroleum fuel less draught is required, and combustion can be so regulated that practically no smoke is produced. At the back of the furnace an opening is made to regulate the temperature, and to increase or decrease the supply of air. The petroleum furnace can generally be made ready for working in from 2½ to 3 hours, and not more than 4–5 cwt. of petroleum are required for every three "blooms" dealt with.—A. S.

Gold Recovery, Permanganate Process of. Eng. and Mining J. 1899, **68**, [20], 572.

The limitations, as stated by the inventors, to the Black-Etard permanganate process for the extraction of gold from complex and refractory ores (this Journal, 1898, 460) are described, and other objections are put forward. One of the most important objections is the extreme delicacy of the process, and the extent to which its operation can be interfered with or prevented altogether by substances of common occurrence, such as iron pyrites, magnetic oxide of iron, and the like.

Also the extraction claimed is no greater than can be obtained by cyaniding the ore, and not so high as with the ordinary chlorination process, which is also much simpler and less delicate, and does not require a dead roast.

Apart from the cost of roasting, the expense for the chemicals used in treating ore by the permanganate process is higher than the similar cost in cyaniding, or even in barrel chlorination.—A. S.

Silver Ores, &c., The Jackson System of Treating. A. Van Zwaluwenburg. Eng. and Mining J. 1899, **68**, [13], 363—364.

The author, as the result of a thorough investigation of the Jackson system of treating silver ores (this Journal, 1899, 768), concludes that attempts to precipitate silver in the metallic form from thiosulphate solutions must end in failure, owing to the extreme instability of the salt. It is possible to precipitate the silver with other metals and with the electric current, but any deviation from the very delicate conditions required results in the immediate decomposition of the solution, and the consequent contamination of the deposited metal with sulphides, &c. In operating upon very small quantities of ore, when no economy of material, time, and space is attempted, it may be possible to extract the precious metals in some form by the Jackson process, but in actual practice, it is very doubtful if the metals can be completely removed from the solution in the manner proposed, even with a plant which is large, and out of all proportion to the quantity of ore treated. The waste of thiosulphate must also be very great.—A. S.

Fume of Lead Furnaces, Liquid from the. M. W. Iles. Eng. and Mining J. 1899, **68**, [20], 576.

The author describes the method of separating dust from the fume at the works of the Globe Smelting and Refining Company, and states that from the gaseous products, a liquid has separated at rare intervals—possibly once or twice during the last five years—but only during the winter season; and it was found possible, during a short period of the day after exceedingly cold weather, to collect a sample of the liquid from the extreme end of the bag-house conduit pipe, which is an unlined circular sheet-iron pipe, 8 ft. in diameter. The vapours as they traverse the large pipe become so cooled as to cause a collection of watery material at the extreme end of the pipe. The liquid passes out through the end canvas bag, which is attached to a 2-ft. "thimble" on the bottom of the conduit, and the whole bag becomes thoroughly saturated with it. As the liquid exudes through the cloth, it freezes and forms long, yellowish icicles, which rapidly drop off as the weather moderates. The bag referred to is used only for cleaning out the pipe, and not for filtration purposes.

A number of the icicles were allowed to melt gradually in a clean vessel, the liquid carefully filtered and subjected to analysis. It had the following composition:—$FeSO_4$, 88·40 grms. per litre; $MnSO_4$, 0·68; $ZnSO_4$, 24·56; As_2O_3, 1·45; NaCl, 7·26; Na_2SO_4, 3·69; K_2SO_4, 2·22; $(NH_4)_2SO_3$, 33·00; H_2SO_4 (free), 1·22; H_2SO_3 (free), 15·00; organic matter, 31·94; total, 209·42 grms. per litre.

The author discusses the question of the cause of the presence of the different constituents of the liquid, and states that undoubtedly the greater part of the ferrous sulphate is due to the action of the acid liquid on the rust which is formed on the inner surface of the iron tube.

—A. S.

Iron and Steel, Determination of Chromium in. E. Dohler. Chem. Zeit. 1899, **23**, [16], 868.

See under XXIII., *page* 1157.

Nickel, Determination of, in Nickel Steel. G. W. Sargent. J. Amer. Chem. Soc. 1899, **21**, [10], 854.

See under XXIII., *page* 1157.

White Metal, Analysis of. H. Nissenson. Chem. Zeit. 1899, **23**, [81], 868.

See under XXIII., *page* 1157.

Copper, Action of Acetylene on. H. Alexander. Ber. **32**, [13], 2381.

See under II., *page* 1110.

Iron Ore, Determination of Titanic Acid in. J. Brakes. *See page* 1067.

PATENTS.

Wrought Iron or Wrought Steel and Cast Steel, Ingots Compounded of. T. Turner, Kilmarnock. Eng. Pat. 26,851, Dec. 20, 1898.

In making ingots compounded of wrought iron or wrought steel and cast steel, the bars of the wrought metal, around and between a number of which the molten cast steel is poured, are of oblong or rectangular cross section, and so placed side by side that the broader side always overlaps a space between others; consequently there are no layers of the cast metal running completely across the compound ingot. The wrought metal bars may also be perforated in places to allow the cast metal to flow through and thus bind the whole together, and they may also be bent in the direction of their length in a curved or zigzag fashion, so as to have no straight line of cast metal running the full length of the ingot. If wrought metal plates be used, they are preferably bent in the direction of their breadth, and placed alternately with their curvatures towards and overlapping one another.—A. W.

Enamelling or Treating Steel and Homogeneous Iron for the Manufacture of Goods to be Enamelled, and Producing Enamelled Goods or Ware. A. M. Clark, Middlesex. From "The National Enamelling and Stamping Co.," New York, U.S.A. Eng. Pat. 10,790, May 23, 1899.

By this process, steel or iron is brought into a condition specially adapted for receiving and retaining a coat of enamel. The process consists in adding to the molten metal one or more of the enamel fluxes, similar or analogous to the fluxes intended to be used in subsequent enamelling. Steel or iron so treated can be cast, rolled, or otherwise worked into any desired shape.—H. H. B. S.

Ores, Treatment of, and the Precipitation of Precious Metals from their Cyanide Solutions. F. W. Martino and F. Stubbs, both of Sheffield. Eng. Pat. 25,979, Dec. 8, 1898.

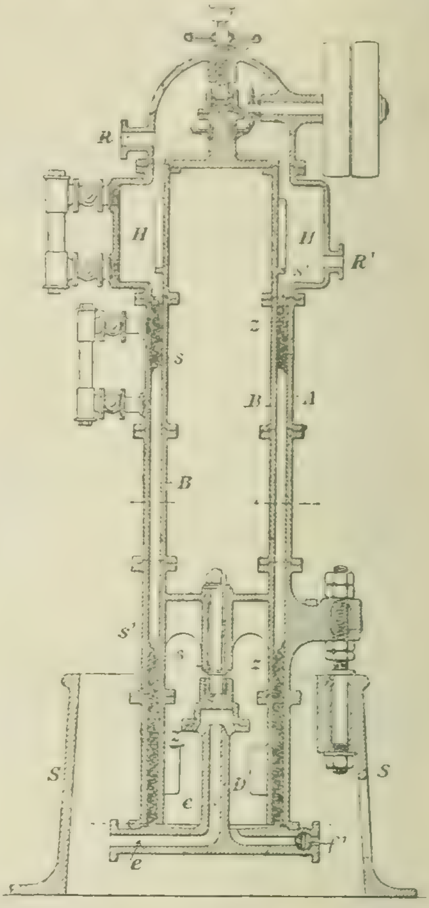
The employment of acetylene in the treatment of ores or tailings containing precious metals is claimed, also in the precipitation of the same from their cyanide solutions. Claims are also made for the employment of acetylene and air in the precipitation of precious metals from their cyanide solutions, for the precipitation of the same by adding calcium carbide to their cyanide solutions, and for the treatment of the ores, &c., by finely dividing and mixing them with calcium carbide and moistening the mixture to set free the gold (this Journal, 1899, 1026 and 1027; Eng. Pats. 4925 and 5034).—A. W.

Sulphide Ores, Process for Roasting. E. C. H. Pape and C. A. L. W. Witter, both of Hamburg, Germany. Eng. Pat. 12,512, June 15, 1899.

The finely divided mixed sulphide ores are fed through a hopper into a heated combustion chamber supplied with previously heated air, whereby the metallic oxides are produced. A portion of these, chiefly oxide of zinc, with some silver, lead, &c., pass off with the resulting furnace gases from the combustion chamber, to be collected in separate chambers or receptacles, whilst the non-metallic constituents, with the greater part of the oxides of lead, silver, iron, copper, &c., fall down to the bed of the combustion chamber.—A. W.

Precious Metals from Minerals, Amalgamating Apparatus for Extraction of. A. Lavoix, Paris. Eng. Pat. 25,983, Dec. 8, 1898.

The apparatus, as shown in the accompanying drawing, is claimed, together with the various points thereof, for the purpose of working the same. It consists of a vertical cylinder, A, resting upon a base, S, by three regulating screws, which permit of its adjustment in combination with an inner concentric cylinder, B, open at the under part, with a perfectly horizontal edge, supported in the first cylinder by means of a central pivot, D. The inner cylinder is made to rotate by means of driving gear at the top, and is provided on its outer surface with rings of teeth or pins, s, keyed one above the other to the cylinder. The teeth are arranged alternately with corresponding teeth, s^1, in cast-iron rings attached to the inner surface of the larger and stationary cylinder. These teeth may be modified by being screwed into the cylinder B, and by being cylindrical instead of having a flat or rectangular section, in which case the teeth on the outer cylinder are dispensed with, and alternating ribs are provided to give the necessary zigzag movement and retardation of flow.



The mineral matters in suspension in water are forced through the hollow centre, *e*, of the pivot, D, passing downwards to the bottom of the inner cylinder and upwards through the mercury, filling the annular space between the two cylinders, the rotation of the inner one keeping the mass constantly and intimately mixed for amalgamation. The water and residues pass into the enlarged annular space, H, and through the exit, R, or, if clearing out, through R^1. The amalgam is passed out through the blow-off cock, f^1. An outer casing may be provided as a protection, if necessary, from cold.—A. W.

Bismuth or Antimony, Humid Process for the Extraction of the Metals, from their Sulphide Ores. J. Ranald, London. Eng. Pat. 16,622, July 30, 1898.

Bismuth and antimony are extracted from their sulphide ores by subjecting them, when crushed, to the action of ferric chloride at or near a boiling temperature, and precipitating the metals from their resulting chlorides by metallic iron. The latter is afterwards recovered by electrolysis from the solution, in which all the iron is present as ferrous chloride, and the portion of the iron not precipitated is reconverted at the same time into ferric chloride, to be used again as the original solvent. Two equations are given:—

$$Bi_2S_3 + 6FeCl_3 = 6FeCl_2 + 2BiCl_3 + S_3$$

$$3FeCl_2 = 2FeCl_3 + Fe.$$

—A. W.

Heating Air or Gases, Means and Method for. H. Niewerth, Berlin, Germany. Eng. Pat. [illegible], Nov. 6, 1898.

Air or gas is heated (e.g., for blast-furnace working, making steel castings, &c.) by means of hot sand or other finely granulated substance, which passes through closed chambers. The sand, after leaving one or more heating furnaces, falls through a hopper into a closed chamber containing a series of horizontal floors from wall to wall. In each floor is a series of slotted holes, through which the hot sand falls on to a plate close underneath, which is also supplied with slotted holes, through which it again falls on to the next floor below, the plate and floor in each case being so arranged that the sand falling between them acts as a barrier and prevents the air passing up through the holes. The air enters at the lowest floor, and is made to pass horizontally across the falling hot sand into a passage in the wall leading up to the next floor above, and so on **backwards and forwards across each successive floor,** meeting with hotter sand as it approaches the exit near the top.—A. W.

Hardening Aluminium, Increasing its Strength and Elasticity, A New Fine Alloy for. G. E. Bourgoin, Paris. Eng. Pat. 23,386, Nov. 7, 1898.

From 2 to 6 parts by weight of copper, 1 to 3 of nickel, and 1 to 2 of fine cast steel are melted together in a non-**silicious crucible, previous to the incorporation of 1 part** of pure aluminium. When the whole is molten, 2 to 3 parts of an "amalgam" of 1 part by weight of tin and 2 parts of aluminium are added, whilst the mass is protected by a layer of powdered vegetable charcoal and of powdered salt in equal quantities. Potassium ferrocyanide is also added, to reduce any oxide formed, and the alloy is cast. Alumi**nium is hardened by being mixed, in a molten condition, in** a non-silicious crucible, with from 2 to 8 per cent. of the alloy.—A. W.

Nickel Alloys, Manufacture of. J. P[illegible], Frankfort-on-Maine, Germany. Eng. Pat. [illegible], Dec. [illegible], 1898.

An alloy of nickel and magnesium is made by melting the nickel, to which fluorspar and [illegible] have been added, in **the presence of chloride or other compound of magnesium.** A triple alloy containing a high percentage of zinc may also be prepared by adding pieces of zinc to the [illegible], passing the same through the layer of slag, and keeping **them at the bottom of the nickel-magnesium bath. A nickel-copper alloy is likewise prepared by adding copper** to the nickel bath prepared as before, either before or after the addition of zinc.—A. W.

Aluminium, Soldering or Brazing. T. C. Van [illegible], **Aardenbourg, Holland. Eng. Pat. 26,393, Dec. 13, 1898.**

Aluminium is soldered to aluminium or other metal by preparing the parts with an alloy of zinc and aluminium **capable of combining with aluminium under the action of** heat, and of being soldered by a solder having a base of **tin. A claim is made for the process with a preparing** alloy composed of about 95 parts of zinc and 5 parts of aluminium, and with a solder composed of 2 parts of tin and **1 part of lead.—A. W.**

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

***Alkali Chloride Solutions, Electrolysis of.* H. Wohlwill.** Zeits. für Elektrochem. 1899, 6, [14], 227—230.

The author discusses the views of Foerster (this Journal, 1899, [illegible]). The present diversity of opinion is a renewed proof in favour of the general principles laid down by **Nernst, *viz.*, simplification and constancy in the condi**tions of experiment, application of the lowest possible electromotive force, and especially the measurement of the separate potentials.—J. S.

Coal, Graphite, Carbons, Carbon Anodes, &c., X-ray Estimation of. H. Couriot. Eng. and Mining J. 1899, 68, [19], 547.

See under II., *page* 1108.

Chromic Acid, Regeneration of [Electrolytically], from Solutions containing Chromic Salts. Zeits. Elektrochem. 1899, 6, [17], 256.

See under VII., *page* 1124.

PATENTS.

Vacuum Dielectrics, Electrodes, and Apparatus for the Production of Ozone. D. Martini, Tilford. Eng. Pat. 14,714, July 4, 1898.

This apparatus consists of a vessel containing a number of **long and narrow vacuum dielectrics of square section, each of** which contains an electrode, and has another pressing against its outside surface. The electrodes, which are flexible and **elastic, are formed of fine copper gauze, through which are** passed short lengths of wire, so as to give them a mop-like surface, or they may be made of a fox-tail pattern. One end of the ozoniser is closed by a frame covered with linen or cotton cloth, which serves to filter the air, and the other is connected to a rotary fan, which sucks the air through the ozoniser.—G. H. R.

Galvanic (Two-Fluid) Batteries. [Depolarisers.] C. Levetus, Handsworth. Eng. Pat. 22,070, Oct. 20, 1898.

The depolarising liquid is formed of a mixture of hydro**chloric and nitrous acids, with or without the addition of** nitric acid; or of hydrochloric and nitric acids, and any **suitable alkaline nitrite. These solutions are regenerated by passing chlorine or oxygen ozone or peroxide of hydrogen through them, or by adding to them an oxide of** nitrogen, with or without the addition of chlorine or oxygen. Nitrosyl chloride may be also employed as the de**polariser, or nitric acid into which nitrogen pentoxide has** been passed.—G. H. R.

Electrolytic Baths. G. Marino, Brussels, Belgium. Eng. Pat. 22,[illegible], Oct. 27, 1898.

In the case of salts which are soluble in glycerin this solvent is employed in lieu of water in the preparation of the baths. **Or glycerin is added to the solutions of salts which are not soluble in it.—G. H. R.**

Galvanic Batteries (Primary). C. Levetus, Handsworth. **Eng. Pat. 23,306, Nov. 5, 1898.**

An arrangement is described for simultaneously and automatically supplying all the cells of a battery with electrolyte.—G. H. R.

Plates or Elements for Secondary Batteries or Electrical Accumulators, Manufacture and Production of (Faure Type). C. Brault, Clichy, France. Eng. Pat. 26,343, Dec. 13, 1898.

The plates are made by compressing between two lead grids a powder which has been prepared by submitting a **moistened mixture of litharge and of a salt of an alkali or of an alkaline earth, to the action of ammonia gas, allowing it to dry, after kneading, and then reducing it to powder; or these substances may be mixed dry and then moistened** with ammonia. The negative plates are similarly prepared, with the addition to the powder of a salt of platinum or of **mercury, or of a double salt of the two metals.—G. H. R.**

Primary Batteries (Reservoir). H. T. Harrison, London. Eng. Pat. 26,703, Dec. 17, 1898.

The electrolyte is supplied to cells connected in series from a trough arranged with dividing partitions, so that the cells **are insulated from one another. The fluid is admitted to the trough, as required, by means of an electrically actuated** valve, automatically controlled by a relay, and there is another relay which cuts off the supply of liquid when the E.M.F. of the battery becomes excessive.—G. H. R.

(*B.*)—ELECTRO-METALLURGY.

Electrolytically Liberated Metals, The Reducing Action of. [*Electrolytic Indigo Vat.*] A. Binz and A. Hagenbach. Zeits. für Elektrochem. 1899, **6**, [18], 261—271.

The authors have investigated experimentally the grounds for and against the assumption of a direct reducing action of metals on colouring matters, and have arrived at the following conclusions.

Former statements with regard to the direct reduction of indigo-blue (this Journal, 1898, 759—760, and 1898, 1141) by metals are confirmed.

Comparative experiments with colouring matters soluble in water were made, and it was found that sodium and potassium amalgam reduce the soluble colours more rapidly the less the quantity of hydrogen evolved. The same velocity of reduction could not be attained with hydrogen alone, although equivalent in amount to the metals. Especially was this found to be the case when the hydrogen was liberated electrolytically with a low current density.

Zinc, liberated from an alkali zincate solution at a mercury cathode, also reduced the colouring matters more rapidly than the equivalent quantity of hydrogen with a low current density. Reduction also occurred when zinc and lead were liberated from acetate solutions at a mercury cathode.

The authors consider that the simplest explanation which can be given of their experimental results is, that the colouring matters soluble in water are of course reduced by nascent hydrogen, but that they are also, and much more rapidly, reduced directly by sodium, potassium, and zinc.

—J. S.

Electrodes of Platinum Gauze, Determination of Metals with. C. Winkler. Ber. **32**, [13], 2192.

See under XXIII., *page* 1156.

PATENTS.

Metals, Electro-Deposition of. S. O. Cowper Coles, London. Eng. Pat. 21,974, Oct. 19, 1898.

Deposition is made on a mandrel rotated at so high a rate of speed that the friction between it and the electrolyte produces a tough deposit without the use of burnishers.

—G. H. R.

XII.—FATS, OILS, AND SOAP.

Fatty Oil of Tropæolum Majus. J. Gadamer. Arch. der Pharm. **237**, 471; Chem. Centr. 1899, **2**, [14], 669.

The oil obtained from the seeds of this plant by means of ether deposits in abundant quantity, at the ordinary temperature, crystals consisting chiefly of the glyceride of erucic acid, tri-erucin, $(C_{22}H_{41}O_2)_3C_3H_5$. Its iodine value is 74·5. By the action of nitrous acid, the author prepared from the tri-erucin, tribrassidin, melting point, 54°—54·5° C., the melting point of which, contrary to the statement of Will and Reimer, was not altered by the heating above its melting point (to 100° C.). About 1 per cent. of phytosterin could be isolated from the saponified oil.—A. S.

Butter Fat, Chemical Composition of.—II. C. A. Browne, jun. J. Amer. Chem. Soc. 1899, **21**, [10], 807—827. (This Journal, 1899, 780.)

In his research on this subject, the author employed Heintz's method of fractional precipitation with some modifications. A butter with iodine value 29·28 was separated into soluble and insoluble acids. Of the latter, 86·4 grms., obtained from 100 grms. of the fat, were dissolved in 95 per cent. alcohol, of which so much was used that nothing crystallised at 25° C. The solution was cooled to zero, and after several hours the crystalline deposit was filtered off through an ice-jacketed funnel. This precipitate was termed Portion I., and the acids in the filtrate Portion II. In order to remove as far as possible the small quantity of oleic acid left in the precipitate, Portion I. was recrystallised from a small quantity of alcohol, and the filtrate added to Portion II.

Portion I. was recrystallised from about 500 c.c. of alcohol, the precipitate filtered off at zero being Part 1. The filtrate from this was evaporated to about 300 c.c., cooled in ice-water, and the deposit (Part 2) filtered off as before. The filtrate was concentrated to about 150 c.c., and the crystallisation repeated, giving Part 3, whilst the final filtrate was added to Portion II. These three fractions were washed with ether into weighed beakers, the solvent evaporated, and the residues dried and weighed.

Portion II. was fractionally precipitated with a 5 per cent. alcoholic solution of magnesium acetate, and the fatty acids liberated from the three fractions *a*, *b*, *c*, washed, dried, and weighed.

The iodine and saponification values of each of these six fractions were determined, and the composition of the acids calculated by means of the usual formulæ. The results are given in the subjoined table :—

	Portion I.			Portion II.			Total.
	Part 1.	Part 2.	Part 3.	Part *a*.	Part *b*.	Part *c*.	Per Cent.
Weight of fraction	5·20 grms.	6·01 grms.	21·18 grms.	9·22 grms.	7·82 grms.	5·05 grms.	..
Mean molecular weight	272·20	260·00	260·70	254·60	254·50	251·20	..
Iodine value	3·44	10·94	15·03	8·41	19·85	25·12	..
Oleic acid, per cent.	3·82	12·14	16·68	9·34	22·03	27·88	..
Mean molecular weight after deducting oleic acid.	271·80	257·20	256·80	252·10	247·70	241·00	..
Weight of stearic acid	2·95 grms.	0·25 grms.	0·56 grms.	..	..	..	3·76
„ palmitic acid	2·05 „	5·03 „	17·05 „	7·32 grms.	4·44 grms.	1·79 grm.	37·68
„ myristic and lauric acids	..	..	..	1·05 „	1·66 „	1·85 „	4·56
Undetermined	..	..	..	..	..	..	7·90

The above calculations were based on the assumption that oleic acid was the only unsaturated fatty acid present, and that the iodine value furnished a correct measure of its amount. After making a correction for the oxy-acids present in the first fraction, the amount of which was calculated from the average acetyl value of the insoluble fatty acids of butter fat, the author arrived at the following as the composition of the insoluble acids examined:—Dihydroxystearic acid, 1·00; oleic acid, 32·50; stearic acid, 1·83; palmitic acid, 38·61; myristic acid, 9·89; lauric acid, 2·57; total, 86·40 grms. These results confirm the work of Koefoed, who found only 1·83 per cent. of stearic acid in butter fat; and of Hehner and Mitchell, who obtained only small percentages of that acid in numerous samples, and in some cases none at all (Analyst, 1896, 316).

For the examination of the soluble acids the following method, based on solubility differences, was devised by the author:—1 grm. of the mixed acids was treated with 25 c.c. of water at 0° C., and the flask left for about five minutes in ice with frequent agitation. The deposit was collected on a filter surrounded with ice, and washed with not more than five successive portions, of 5 c.c. each, of the cold water, the washings being added to the filtrate. The acids on the filter were washed back into the flask with 25 c.c. of water at 30° C., and, after being kept at that temperature for about five minutes, again filtered off. The acids remaining on the filter after washing with water at 30 C., were then treated successively in the same manner with water at 60° C. and at 95° C., yielding fractions 3 and 4.

In one experiment by this method the following results were obtained :—

Fraction.	Temperature of Water.	Mean Molecular Weight of Acids.
	° C.	
1	5	91·4
2	30	113·1
3	60	123·6
4	95	..

The weight of acids in each fraction was calculated by means of the formula—

$$W = \frac{M\,n}{10{,}000},$$

in which W represents the weight in grms. of acids, M the mean molecular weight of the acids, and n the number of c.c. of decinormal alkali required to neutralise them. On calculating the results to the amount of soluble acids in the original fat the author obtained :—Butyric acid, 5·45; caproic acid, 2·09; caprylic acid, 0·49; capric acid, 0·32; total, 8·35 per cent.

The amounts of triglycerides of the total mixed acids of the fat were thus: Dihydroxystearin, 1·04; olein, 33·95; stearin, 1·91; palmitin, 40·51; myristin, 10·44; laurin, 2·73; caprin, 0·34; caprylin, 0·53; caproin, 2·32; and butyrin, 6·23 per cent.

The chemical constants of this fat, determined by the usual methods, were :—Saponification value, 232·7; ether value, 232·5; iodine value, 29·28; molecular weight of insoluble acids, 260·3; molecular weight of soluble acids, 98·0.

With regard to the existence of mixed glycerides in butter fat, the author remarks that, whilst the evidence is strongly in favour of their being present, there are, in his opinion, equally good reasons for believing in the existence of simpler bodies. Thus, by separating butter fat into a more solid and more liquid portion by congealing it at a low temperature, and repeatedly crystallising the butter-palmitin from chloroform, it is possible to obtain almost pure tripalmitin containing only traces of oleic, stearic, and other soluble acids.—C. A. M.

Cotton-Seed Oil, Occurrence of Organic Chlorine Compounds and Absence of Sulphur Compounds in. P. N. Raikow. Chem. Zeit, 1899, **23**, [75], 769—770, and [77], 802.

APPLYING the test described in a former paper (this Journal, 1898, 797), the author has found that cotton-seed oil gives a characteristic red colour with phloroglucol-vanillin, which he at first attributed to the presence of sulphur compounds. From further investigation he has come to the conclusion that the colour is produced by organic chlorine compounds, for in many samples of oil from four different sources he has invariably found chlorine, but never sulphur, in which respect his experience differs from that of Dupont (this Journal, 1895, 811). This chlorine compound is insoluble in water and alcohol, and is non-volatile with steam, though somewhat volatile in superheated steam.

Olive oil and walnut oil, which did not give the red colour with phloroglucol-vanillin, contained neither sulphur nor chlorine compounds, whilst colza and rape-seed oils, which gave a marked reaction, contained sulphur but no chlorine. On distilling these latter oils in a current of steam a considerable amount of sulphur was found in the distillate, and after eight hours' distillation the oil left behind no longer gave the red coloration.

Provided that it be proved that the chlorine compound is an invariable constituent of cotton-seed oil, it may be found possible to identify that oil in mixtures by the phloroglucol-vanillin test supplemented by the detection of chlorine in the products of the combustion of the oil. The amount of the compound found by the author in oils of different origin has shown considerable variation (this Journal, 1899, 771).
—C. A. M.

Croton Oil, Characteristics of. W. Dulière. Ann. de Pharm. de Louvain, 1899, 229 and 278; through J. Pharm. Chim. 1899, **10**, [7], 305—306.

THE author states that croton oil, obtained by extraction with petroleum spirit or by cold expression, has the same characteristics as the official oil, but that oils prepared by hot expression, or by extracting the non-decorticated seeds with ether, differ from it in colour, acidity, and degree of solubility in absolute alcohol, although the chief chemical constants are practically identical.

In the subjoined table of these constants the acetyl value was determined by Lewkowitsch's method (this Journal, 1897, 507), which the author has found to yield very exact results :—

Specific gravity at 15° C.	0·9437
" " 100° C.	0·8874
Solubility in alcohol (92 per cent.).......	1 in 63
Critical temperature (Crismer)	54·8
Refractive index (Butyrorefractometer) .	77·5 at 27° C.
" " (Oleorefractometer)	+ 35 at 22° C.
Acid value (Burstyn)......................	21·8
Saponification value......................	215·6
Solidification point of fatty acids.........	16·1° to 16·7° C.
Reichert-Meissl value.....................	12·1
Iodine value (after 2 hours)..............	100·37 to 101·91
" " (after 12 hours).............	103·63 to 104·39
" " of fatty acids (2 hours)......	111·23 to 111·76
Acetyl value.............................	38·64

The presence of castor oil may be detected by converting the ricinoleic acid into sebacic acid. This reaction, though sensitive, cannot be used as a quantitative test; but the author states that the difference between the acetyl values of croton and castor oils enables one to make a correct estimation of the amount of the latter.

Hydrocarbons, which, it is stated, are frequently added to croton oil, may be detected by distilling the sample in a current of steam, and their amount may be calculated from the saponification value.—C. A. M.

Cocoanut Oil, On the Fatty Acids of. F. Ulzer. Chem. Rev. Fett- u. Harz-Ind. **6**, [11], 203—204.

Two samples of refined commercial cocoa-nut oils, exhibiting the following constants, were examined :—

—	Saponification Value.	Iodine Value.	Reichert-Meissl Value.
I.	259·9	9·1	8·5
II.	258·8	9·2	8·3

The mean molecular weights of the volatile fatty acids were found to be 123·3 and 121·5, their percentages being therefore 2·09 and 2·02 per cent. respectively.

For the investigation of the insoluble fatty acids, 100 grms. of No. 1 sample were distilled below 190° C, under partial vacuum (15 mm.). The first fraction (50 per cent.) gave an acid value 273·9 (molecular weight, 204·5), and the second (30 per cent.), the acid value 261·1 (molecular weight, 214·5); the residue (20 per cent.) giving the value 257·1, and molecular weight, 217·8. On recrystallising the latter fraction three times from David's alcohol-acetic acid mixture (300 : 220), to remove the palmitic acid assumed to be present in this oil, a residue of 2·5 grms. was obtained, the acid value of which was found to be 253·8, the mean molecular weight, 220·6, and the melting point 34° C., thus indicating a very low proportion of palmitic acid, if any at all.

Another portion of the same residue was converted into lead soaps, the separation of which into liquid and solid portions was effected by digestion with ether. On decomposing the solution and eliminating the solvent, the small quantity of fatty acid remaining gave the iodine value 66·5. When oxidised with permanganate and recrystallised from alcohol, an impure dihydroxystearic acid (m.p. 132° C.) was obtained, thus definitely indicating the presence of oleic acid in the oil, to the extent (according to the iodine value) of about 10 per cent.

From these results it would appear that the sample contained about 2·32 per cent. of the triglycerides of volatile fatty acids (chiefly caproic and caprylic acids), and about 10—15 per cent. of triolein, the remainder consisting of trilaurin and trimyristin with a little caprin. The presence of tripalmitin is regarded as doubtful.—C. S.

Phytosterin and Cholesterin in Fats, Detection and Estimation of. H. Kreis and E. Rudin. Chem. Zeit. 1899, **23**, [92], 986.

See under XXIII., *page* 1158.

Sesame Oil, Investigation of Bishop's Reaction for. H. Kreis. Chem. Zeit. 1899, **23**, [77], 802.

See under XXIII., *page* 1158.

PATENTS.

Waste Fish and other Offal, Apparatus for Treating and Drying. J. F. Johnson, London. Eng. Pat. 25,660, Dec. 5, 1898.

See under XIV., *page* 1140.

[*Oil*] *Presses for Expressing or Filtering Liquids from Solids.* G. J. Clarkson, Stockton-on-Tees. From C. E. Snypp, Gretna, Louisiana, U.S.A. Eng. Pat. 16,614, Aug. 16, 1899.

This specification describes a form of horizontal press wherein (more particularly) cotton seed can be freed from oil without the necessity for wrapping the material in cloths before submitting it to hydraulic pressure. There are a number of filter boxes filled with seed from a conveyer which has a movable aperture, and which is supported over and parallel to the apparatus; these boxes contain perforated filter plates of special design, and are pressed together by means of the usual ram; while the lower side of the boxes is closed by a door which can be opened to withdraw the cake at the end of the operation. There are nine claims for the press as a whole, for the conveyer, for the press boxes, for the hinged door thereof, and for various types of filter plate; four sheets of drawings are appended.—F. H. L.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—PIGMENTS, PAINTS.

PATENT.

Lead Oxide, Apparatus and Method employed in the *Production of, and the Treatment of Rough Litharge.* "Matthews' Lancashire, Cheshire, and N. Wales District White Lead Co., Ltd.," S. Pope, and G. V. Barton, Runcorn. Eng. Pat, 21,830, Oct. 17, 1898.

This specification describes apparatus for agitating molten lead in a current of hot air and superheated steam, leading the vapours into brick chambers and finally condensing the fume with water. The essential feature lies in the construction of the pan in which the metal is heated, and in the agitating device. "Rough litharge" may also be worked up in the same plant. There are three sheets of drawings.

—F. H. L.

(*B.*) RESINS, VARNISHES.

Exudation Resins. M. Bamberger and A. Landsiedl. Monatsh. Chem. **20**, 755—761.

The authors have investigated the isomeride of lariciresinol of lower melting point, referred to in their former paper (this Journal, 1899, 1033). By the continued action of boiling alcoholic solution of potash, or of sodium ethylate or amylate on lariciresinol (melting point 169° C.), they obtain an isomer melting at 95° C. It is very soluble in alcohol, but is precipitated from the solution by petroleum spirit, and is decomposed, with evolution of inflammable gas, at 115°—120° C. When heated with benzene, whether in solution or in suspension, it is converted into a substance melting at 152° C., which, on recrystallisation from weak alcohol or from a mixture of alcohol and petroleum spirit, yields the original substance of low melting point. Acetyl chloride or acetic anhydride converts it into the tetra-acetyl derivative formerly described. The dimethyl ether is isomeric with, but the diethyl ether seems to be identical with, the corresponding compound of lariciresinol.—J. T. D.

Resinates and Oleates, Metallic, Employed as Driers. Summary of the researches of Amsel, Bottler, Lippert, and Weger, by Livache. Bull. de la Soc. d'Encourag. pour l'Indust. nat.; through J. Pharm. Chim. 1899, 6 ser. **10**, (7), 322—328.

Preparation of Resinates.—Until recently, "concentrated driers" consisted of the plaster-like products obtained by heating linseed oil to 250°—260° C., with a variable quantity of red lead, litharge, manganese acetate, manganese borate, &c., while "liquid driers" were obtained by treating these products with oil of turpentine, and filtering off from the insoluble matter. In the latter form, the driers might be added to an oil without affecting its clearness. Now, however, more definite bodies are being used as substitutes for these ill-defined and complex mixtures of metallic resinates. These salts are now generally prepared from colophony, occasionally from white or red Angola copal, or from yellow Benguela copal. The powdered resin is saponified with an alkaline hydrate or carbonate; the soluble alkaline resinate thus obtained is used to precipitate the metallic salt from its aqueous solutions, by double decomposition. The precipitated metallic resinate thus formed is washed and dried between 30°—40° C., at which temperature it will retain about 6 per cent. of water. In the case of manganese resinate, exposure to the atmosphere must be avoided, as far as possible, since oxidation takes place readily, and the colour rapidly changes from yellowish white to dark brown. Sometimes the oxides of lead and manganese are merely melted with the resin; but this method gives products which are inferior to those obtained by precipitation; on the other hand, they possess the advantage of being free from water. Colophony gives the best results when it is most translucent, in which condition it is obtained by prolonged fusion, until, according to Wiener, the crystalline abietic acid is transformed into its amorphous anhydride. Since, according to Maly, colophony consists of 80 parts of abietic acid and 20 parts of silvic acid, and the formulæ for lead abietate and silvate are respectively $Pb.C_{44}H_{62}O_5$ and $PbC_{40}H_{58}O_4$, it follows that lead "resinate" will consist of 77·1 parts of lead abietate and 22·9 parts of lead silvate; manganese "resinate" has an analogous composition. These are the two resinates most often employed; the oleate and linoleate of manganese are sometimes used, but are very difficult to obtain in an anhydrous state.

Addition of Solid Resinates to Linseed Oil.—According to Max Bottler (Dingler's Polyt. J. 1898, 70), one part of the dry and powdered resinate is added to 4 parts of linseed oil, heated to 150° C., at which temperature the mixture is maintained for some time, with constant agitation; it is then diluted with linseed oil, until it contains the requisite amount of the metal. When copal resinates are employed, the powders must be very finely divided, and the temperature of the oil higher, ranging to 165° to 180° C.; the mixtures must be kept longer at this temperature. Some of these compounds dissolve better in linseed oil when they have been kept for some time, as in the case of lead resinate from white Angola copal. Hot-pressed linseed oil gives results which, in brilliancy, adhesiveness, and drying power, are equal to those obtained with cold-pressed oil, but the solutions in the latter are clearer. Equal parts of linseed and poppy-seed oil give markedly less siccative products, but the pellicles are clearer and more brilliant. The drying power of the solutions is greater after they have been kept a certain time, at ordinary temperatures, than when recently prepared.

Proportion of Siccative to Linseed Oil.—Weger (Zeits. für angew. Chem. 1897, 560) has found that the ratio of manganese to oil should not exceed 0·25 per cent. of metal in the case of manganese resinate; and 0·1 per cent. of manganese and 0·5 per cent. of lead for a mixed resinate of lead and manganese. Manganese resinate prepared by fusion rarely contains more than 3·2 per cent. of soluble manganese, while the precipitated resinate contains 6 to 7 per cent. Fused linoleate of manganese contains from 9 to 11 per cent. of soluble manganese. With regard to the rate of oxidation aided by manganese resinate, W. Lippert (Zeits. für angew. Chem. 1898, 431) finds that, at first, this is more rapid in the presence of a larger proportion of the salt, but that, ultimately, the volume of oxygen absorbed is much greater where less manganese has been used. Practically, a proportion of resinate equivalent to 0·15 per cent. of manganese gives the best results.—J. O. B.

PATENT.

Cleansing Painted, Varnished, or Polished Surfaces, Carpets, Rugs, Oilcloth, Brasswork, and the like; A New or Improved Compound for. C. E. Postlethwaite, Bromley, Middlesex. Eng. Pat. 19,669, Sept. 30, 1899.

A SOLUTION is made of ammonium oxalate, 8 oz.; boric acid, 8 oz.; and glycerin, 53½ oz.; in 1 gall. of water: this is thickened, if preferred, by being poured into a sufficient quantity of a boiling paste of wheat flour and water. The composition is brushed over the surface, allowed to remain for 10 or 30 minutes, removed with warm water, and the object finally polished. Eng. Pat. 12,930, 1895 (this Journal, 1896, 818), is referred to.—F. H. L.

(C.)—INDIA-RUBBER, &c.

India-Rubber, On the Nature of the Vulcanisation of. C. O. Weber. Gummi-Zeit. **14**, [6] and [7], 79, 99.

THE opinion expressed by Höhn (this Journal, 1899, 1034), that the theory of vulcanisation was based upon erroneous views, and for this reason is not in agreement with practice, the author does not admit. It rather appears that no theory of vulcanisation can at the present time be established, owing to lack of facts. It is not probable that a theory of vulcanisation can be formulated until we have a better knowledge of the colloidal state. Höhn terms india-rubber vulcanised "if it possess the strength and elasticity required by the nature of its use." But according to this definition "card rubber" would have to be described as vulcanised, and every vulcanised article possessing some defect would have to be described as unvulcanised. His statement, that rubber could be vulcanised as well with 1 per cent. as with 25 per cent. of S, is incorrect. As disproving any chemical combination of sulphur with india-rubber, he mentions the fact that no spontaneous evolution of heat is ever observed in the vulcanising process. This reasoning is shown to be fallacious. His statement, that the "free sulphur" invariably present in all vulcanised articles is simply due to the presence of coarse particles of sulphur in the flowers of sulphur employed in vulcanising, is quite at variance with the results of numerous analyses, and he gives no proof whatever in support of this astounding assumption. According to Höhn, the vulcanising treatment is not a chemical process, but merely an absorption of sulphur into the cells of the india-rubber. This would mean that all is present as "free sulphur," and so would contradict his previous statement. For the existence of "cells" in india-rubber he produces no evidence. That in the cold vulcanisation of india-rubber a previous softening is required, is not the case. Waterproof cloth can be perfectly vulcanised by exposing it at ordinary temperatures to the vapours of chloride of sulphur. But this process is only applicable when extremely thin films have to be cured; for greater thicknesses it is preferable to dissolve the chloride of sulphur in a solvent which is capable of carrying the vulcanising agents into the film. Such a solvent is carbon bisulphide, and its swelling action does not in any way contribute to the vulcanisation. In order to show that the vulcanising action of chloride of sulphur is due to its sulphur and not its chlorine, Hohn makes the statement that, on continued use, the percentage of chlorine of a vulcanising solution increases, whilst the sulphur decreases. This is certainly not the case, provided the vulcanising operation be carried on under conditions excluding the action of the atmosphere. That, on prolonged immersion in the vulcanising solution, india-rubber evolves hydrochloric acid is no doubt true, but this is an altogether secondary reaction supervening upon vulcanisation. Hohn denies that any action of the chloride of sulphur takes place during the immersion of the latter in the vulcanising solution. The error of this statement is readily proved by mixing a solution of india-rubber with chloride of sulphur, when within a few seconds the former is converted into a very solid jelly. He further assumes that the vulcanising action of chloride of sulphur is due to its decomposition into sulphur and sulphur dichloride, but in what manner the india-rubber is to escape the destructive action of the sulphur dichloride he leaves unexplained. He recognises, however, that his view as to the nature of vulcanisation must necessarily lead to a suggestion to cure with a solution of sulphur in carbon bisulphide. Lastly, Höhn points to the vulcanisation in a sulphur bath as proof positive that the process consists simply in the "absorption" of sulphur by the india-rubber. But the various stages observable in this process, if they prove anything, prove clearly the fact that at the beginning absorption of sulphur in very large proportions always takes place, but as yet no vulcanising effect whatever will have been produced. On increasing the time of immersion, however, or by raising the temperature, vulcanisation then sets in, and its degree is invariably found to be commensurate with the amount of sulphur actually combined with the india-rubber.—C. O. W.

Sulphur, Determination of, in Organic Substances. R. Henriques. Chem. Zeit. 1899, **23**, [81], 869.

See under XXIII., *page* 1159.

PATENT.

Extraction of Rubber, Process and Apparatus for the Extraction of Substances contained in Vegetable and other Bodies, especially applicable to the; and the Recovery of the Solvents Employed. J. de la Fresnaye, Paris. Eng. Pat. 26,157, Dec. 10, 1898.

THIS is a closed apparatus on the continuous system, the leaves, &c. being extracted with warm petroleum spirit in a steam-jacketed vessel, the liquid passing into a still for the recovery of the solvent. When the batch of material is exhausted, water is run into the still, and when the spirit has been driven off for the last time, the rubber collects on the surface and can be removed. To recover the solvent adhering to the waste leaves, the extracting vessel is heated more strongly till the light petroleum volatilises, and the vapours are led through a mass of cold fixed vegetable oil. Finally, this oil is heated by means of a steam jacket, so that the spirit distils over into a separate condenser. The entire plant is figured in the specification.—F. H. L.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Glue and Gelatin, Notes on. S. Lewites. Protok. St. Petersburger polyt. Ver. 1899, 99; through Chem. Zeit. Rep. 1899, 319.

BONE GLUE and leather glue differ considerably in price, but specimens cannot safely be identified by their appearance. The ash of bone glue, however, is neutral, contains much phosphoric acid, and melts on ignition on platinum foil; the ash of leather glue is alkaline, contains little or no phosphoric acid, and does not melt. According to the author, gelatins are best valued by noting the melting and solidifying points of their 10 per cent. solutions; the solution of "gelatin extra" liquefies at 31° or 32° C., and sets at 26° or 27° C.; common white gelatin gives the corresponding figures 22° and 18·5° C. In Russia, isinglass is only met with in two grades (melting point of a 10 per cent. solution 23° or 24° C.), and never contains more than 3 per cent. of matter insoluble in water; American and East Indian samples may contain as much as 25 or 30 per cent. of insoluble matter.

The author gives two reactions for the quantitative determination of gelatin in articles of food: (1.) The material is thoroughly shaken with hot water in a tall test-tube, allowed to settle, and the clear liquor evaporated to a very small bulk on the water-bath. 1 or 2 c.c. of ordinary formalin are next added, and the whole is warmed gently. Even 1 per cent. of gelatin shows itself by the formation of the gelatinous compound, which is insoluble in hot water, dilute acids, and alkalis. Presence of sugar, starch, dextrin, &c. is not prejudicial. (2.) If 1 or 2 c.c. of a gelatin solution are shaken with two or three drops of guaiacol, the liquid remains turbid like milk; on adding a few drops of strong ammonia, it turns rose-red, then loses colour, and finally becomes an intense blue-violet, which is permanent for several months. These latter reactions depend on certain mineral constituents of the glue; pure glutin free from ash is not affected by guaiacol. The formaldehyde test is more certain but less delicate. —F. H. L.

Leather, The Manufacture of. H. R. Procter. J. Soc. Arts, Cantor Lecture No. 2, 47, 2446], 839; [2447], 851; and [2448], 863. (*Continued from page* 1035.)

After the soaking and cleansing of hides and skins, they still require both chemical and mechanical treatment before they are ready for actual conversion into leather. The hair must be loosened, so that it can be removed; the inner or flesh side must be freed from loose underlying tissue and fragments of flesh left on by the butcher. It is also necessary that the gelatinous fibres of the skin should be swollen by some agent, either acid or alkaline, which has the power of splitting the fibre bundles into their finer fibrils, so as to increase their bulk and increase the surface they present to the action of the tanning substance. If, as is usually the case, lime is used, it is necessary to secure its removal if vegetable tans are to be used. Where soft and flexible leather is required, it is necessary to bring the fibres back from their swollen state to a soft and flaccid one, since if tanned in a swollen condition, the leather would be hard, and, in extreme cases, even brittle. The agents, which are used practically to loosen the hair, are putrefactive ferments, lime, and alkali sulphides. The putrefactive method is still largely used in special cases. The hides are hung up in a room, in which they can be moistened by water sprinklers and warmed by steam, and so arranged as to be protected from sudden change of temperature, and with but little ventilation. This process is called "staling," or "sweating," and one of its most important applications is the unwooling of sheep skins. After the previously washed skins have been hung in this way for about a week, the wool is thoroughly loosened, and may be pulled or pushed off by hand and sorted into qualities. It is stated by von Schroeder that the bacteria which are most active in loosening the hair have little effect on the skin itself. There is no doubt that part of the solvent effect on the epidermis is not due alone to the direct action of the bacteria, nor even to the solvent ferments which they produce, but to ammonia, which is freely given off during the process, and acts, like other alkalis, in loosening and dissolving the epidermis. The great danger of the "sweating" method is the spreading of the putrefaction from the epidermis layer into the surface of the true skin. When this takes place, some damage is generally done to the delicate hyaline layer; such damage shows itself on the finished goods by a whitish and dull appearance on the surface. But lime is the general substance used for loosening the hair, and, in common with other alkalis, has not only a solvent effect upon the epidermis, but swells the fibres of the true skin and splits them up into their constituent fibrils, both of which effects are essential for the production of good leather. Its limited solubility ($1\frac{1}{4}$ parts per thousand) renders its action mild, and the employment of excess innocuous. In practice the skins and hides are put into a pit filled with well-mixed milk of lime, and are constantly hauled and replaced until the hair slips. Sole leather tanners frequently use from 10 to 12 per cent. of lime on the raw weight of the skin, but probably not more than 1 to 3 per cent. is actually consumed.

The chemistry of the liming process is very complicated. Its effect is not due to the chemical action of lime alone, but to that of enzyme products of bacteria, without which so weak an alkaline solution would have little solvent action on the epidermis structures. The effect of this combined action is to break down the epidermis matter of the skin, first into soluble forms, identical or nearly so with peptones, and then into simpler and simpler products, such as amines and amido acids, and finally into ammonia, carbonic acid, and water. An old lime will contain, besides the caustic lime, a large quantity of lime combined with weak organic acids, ammonia, peptonised hide substance, living bacteria and their products, some of which are solvent ferments or enzymes. It therefore happens that an old lime is stronger than a fresh lime in its solvent effect upon the hide, but these old limes do not plump like absolutely new limes, which swell the fibre well with little loss of hide substance. Thus, for sole leather, only new or nearly new limes should be employed, while for dressing leather, which requires softness, somewhat older limes may be employed, but care must be taken not to endanger active putrefaction and damage to the skin.

An indirect method of liming has been recently patented by Pullman, which consists in soaking the hides or skins, first in dilute caustic soda, and then in a bath containing a neutral soluble salt of calcium, by which means calcium hydrate is formed in the interior of the fibre of the hide. This process turns out a very satisfactory product, and it has the great advantage that no lime slab, and only a very little quantity of waste liquor, is produced; that the time is much lessened, and the amount of liming effect produced can be regulated with accuracy; and that the soda soap is formed instead of the calcium soap, and thus easily removed. If, however, by this process the skins and hides are perfectly fresh and free from any putrefactive organisms, the full swelling effect of liming can be produced without the hair being in the least loosened, with the result that skins may be thus treated and afterwards tanned with the hair on.

Of late years alkaline sulph-hydrates have been used in conjunction with lime. These have the advantage of quickening the process, but have an injurious action upon the hair. When sulphide of sodium is used, it may be used either alone or in conjunction with lime. The skins and hides may be soaked in a solution, or painted on the hair side with an even paste of the same, in which case the hair is totally destroyed in a few hours. Many other alkaline sulphides have been used, with more or less success.

After the hides and skins have been limed, they are then fleshed, generally by hand, but in America machines are used for the purpose. Where soft and pliable leathers are to be manufactured, it s necessary, after fleshing, to reduce the swollen condition of the fibre produced by the lime, and in some cases also to dissolve a further portion of the cementing substance of the fibres, so as to give the leather more stretch and softness. When only the removal of the lime is desired, this may to a considerable extent be brought about by the mere removal of the alkaline condition caused by the lime. This may be produced by neutralising with acid and the washing out of the neutral salts. It is important that no excess of acid be used. The operation is best performed in a vat or paddle, so that the skins may be kept in motion. Sulphuric acid or hydrochloric acid is suitable, but one of the most useful acids is boric, although salts of ammonia may be usefully employed. But where a solution of a certain amount of the intercellular substance is also required, a simple neutralisation of the lime is not sufficient, and a bran drench must be used. Wood has investigated this subject very fully, and finds that the action of the bran drench is due to bacteria. These organisms are in themselves incapable of fermenting the starch, which is the source of their nutriment, but which must first be converted into glucose by a zymase, which is naturally present in the bran. The fermentation produces, in addition to lactic and acetic acids, considerable quantities of hydrogen. The bacteria are incapable of acting directly on the skins, and therefore a quite similar effect is produced by the action of a very dilute solution of lactic and acetic acids. This obviates the danger of false ferments, which are sometimes present in an ordinary drench, and produce a disastrous effect. This is often the case when the drench follows the process of puering or bateing.

Bateing is a treatment in fermenting infusions of pigeon or hen dung, which is applied principally to the heavier sorts of shoe leather, such as thin ox and cow hides, calf skins, &c. Puering (the name is probably derived from the French *puer*, to stink) is a similar treatment with the excrement of dogs, and is used for the lighter classes of skins, such as glove leather and morocco. In principle the two are similar, but differ considerably in effect.

J. T. Wood has recently done much to clear up the theory of puering, and has shown that the presence of living bacteria is unnecessary, and that in a dog puer, at least, the really active agents are the enzymes, or soluble unorganised ferments, which bacteria have formed, together with organic salts of amines or compound ammonias, which have resulted from their action on the organic matter present. Both these substances have a reducing action on the skin when used alone, but the proper puering action takes place when both are present. Wood has separated the amines from a puer liquor by distillation with soda, and combined them with hydrochloric acid, and precipitated the soluble ferments with strong alcohol. These may be dissolved in water at the rate of $\frac{1}{2}$ per cent. of each, and a liquid will thus be obtained which has exactly the same effect as the original puer, without any danger or injury to the skin from false ferments. He found that similar compounds can be obtained by fermentation of a nutrient gelatin solution with other bacteria than those obtained with puer, and that such a solution can be concentrated *in vacuo* and kept until required for use. So that we may now look forward hopefully to a complete disuse of the dangerous and disgusting processes which have so long been a trouble and a disgrace to the tanner.

Messrs. Popp and Becker have also, independently of Wood, produced a similar artificial bateing preparation, which also gives good results in practice.

In present practice, a puer is made by dissolving dog dung in water, at a temperature of 90° F., to a turbid solution, in which the skins are kept in gentle motion. In time the limy skins become so flaccid that they have a soft silky feel, and can be stretched in any direction without springing back. But it is clear, therefore, that something beyond the mere removal of lime has taken place, and that something, as far as our present knowledge goes, consists in a solution of the cementing substance of the fibres, and in some osmotic effect which causes the swollen fibre to give up its water.

The effect of the bate is less in degree than that of the puer, but similar in character. In making a bate, it is best to exhaust the material in warm water, and allow it to ferment for about a week in a separate tank, using only the clear liquor wherewith to treat the skins, as injurious bacteria are apt to be contained in the sediment, to settle in the folds of the skin, and destroy its grain surface. Mr. Wood explains the difference in the action of the bate and puer to be due to the greater amounts of urates in the former.

While skin is easily putrescible, leather is one of the most imperishable of animal products, and while dried skin is hard and horny, and almost impermeable to air, leather is flexible and porous. It must resist decay. Moist and raw skin consists practically of gelatinous fibres, distended with water, and soft and more or less sticky, and when such material dries, the fibres adhere together and contract into a rigid and horny mass, impervious to air and translucent to light. In converting skin into leather, the adhesion of the fibres must be prevented. We may accomplish this in a variety of ways, such as the replacement of the water between the fibres by some liquid in which they are insoluble, and which will absorb and withdraw the water with which they are swollen, thus allowing them to shrink and harden without adhesion. This result may be rendered permanent by producing chemical changes in the fibres which render them insoluble in water, or their surfaces may be coated with an insoluble, and consequently non-adhesive, layer.

Knapp showed that a piece of raw skin prepared for tanning, if suspended in absolute alcohol, was converted into white leather in which no chemical change has taken place, and which on thorough soaking in water returns to the condition of raw pelt. The change is a purely physical one, and the principles involved are so important to a clear understanding, that it is necessary to study them in some detail. We have to deal with the nature of jellies, and the causes which lead to the swelling of colloid bodies by absorption of liquids, and the converse. It enters into the explanation of every stage of the tanning process, from the soaking of the raw skin to its final conversion in leather. If a sheet of dried gelatin be suspended in water, it will absorb water and swell till equilibrium is reached. If a third substance is added, say alcohol, the outward pressure of the external water is diminished, water passes out of the jelly to restore the equilibrium and the jelly contracts, and if sufficient excess of alcohol is added, the gelatin may be quantitatively separated as a firm, elastic mass. The above explains the action of alcohol in converting the raw pelt into leather.

If well-washed pelt be immersed in a solution of salt, it becomes somewhat swollen; whilst in a dilute solution of any acid the swelling is much greater. A part of the acid in the swollen pelt appears to be simply dissolved in the water absorbed, while another part is more closely united to the gelatin, which latter part no longer obeys the simple laws of equilibrium of solutions, but acts as if it formed a weak chemical compound with the gelatin. A solution of definite strength produces a maximum swelling, which corresponds to a maximum of acid fixed, and as concentration increases the swelling diminishes. The maximum of swelling and acid fixed correspond to different concentrations with different acids, and the amount of acid fixed also varies, following no regular molecular proportion.

The following is the most practical application of the above. Sheep skins unwooled and prepared for tanning are preserved for exportation by what is known as "pickling" with solutions of sulphuric acid and salt. In this condition they are brought from New Zealand and Australia, and are shipped largely to the United States. The pelts, after liming, puering, and drenching, are first paddled in a very dilute solution of sulphuric acid, to which a proportion of salt is added to control the swelling, and are then brought into strong brine, in which they become white and flat, and can now be packed wet in casks, and preserved for months without change.

If the skins in this condition are dried out, they are found to be converted into a white leather, the joint action of acid and salt dehydrating gelatin, as alcohol does. This principle is used in preparing lamb skins for use instead of furs in Eastern Europe, the skins being covered with a mixture of rye meal and brine, and allowed to lie in a tub until the meal ferments. The lactic acid formed brings out the above effects. It was formerly supposed that the function of the brine in the pickling process was to remove the acid, but analyses have shown that, unless great excess of acid has been used, no trace of acid diffuses into the brine, but that any present in it is absorbed by the skin. Skins have been effectually pickled with one-tenth of the acid generally used in commerce, and the process might be simplified and improved by introducing the skins into a saturated brine and gradually adding the calculated quantity of acid, which is all taken up by the skin.

No complete explanation can yet be offered of the tanning effect of the trivalent salts of the iron and alumina group. Not merely the amount of absorbed chromium and aluminium, but the basicity of the absorbed salts varies under different conditions, and there is nothing to contradict the suggestion that the oxide or hydrate rather than any particular basic salt is the essential tanning substance in these cases. This is borne out by the fact that chromic acid and bichromate render gelatin insoluble when reduced by the action of light in the absence of any acid, and that skins may be tanned by chromic acid, and subsequently reduced by alkaline sulphides.

It is only the M_2O_3 salts of these metals which will tan, neither chromic acid nor ferrous salts having that power, although they may both be used as a means of producing the desired compounds in the skin. In practice, tanning, or as it is generally called, "tawing," with alumina salts, is nearly always done with solutions of alum or normal aluminium sulphate, with additions of common salt. Large tanners of calf kid have for some time abandoned the use of alum for that of aluminium sulphate, as the latter is cheaper, and the sole advantage of alum is that in earlier times it was easier to obtain in a state of comparative purity. The strength of solution varies widely for different sorts of leather. Sheep skins are alumed for rugs by applying a strong warm solution (containing about 15 per cent. alum and 10 per cent. salt) repeatedly to the flesh side of the skin stretched on a frame, or in some cases even by rubbing powdered alum and salt into the wet skin. Alum and salt alone is only used with cheaper sorts of leather, while for the finer white leathers, such as glove kid and calf kid, a paste of flour and egg yolk, with addition of olive oil, is generally used in conjunction with the alum and salt.

The egg yolk is mainly useful on account of the finely emulsified oil which it contains and for its albumin; the flour serving as a further source of albuminous matter, but no portion of the starch is absorbed. A mixture of palm oil and olive oil may be used as a substitute for the yolk of egg, and is much cheaper, the oil serving to give softness to the leather by lubricating the fibre. A mixture of olive oil with a little palm oil is chemically identical with egg oil and is much sharper, but the problem is to emulsify it as finely as in egg yolk. Olive oil is in practical use as a partial substitute. After the skins are dried out, they are dipped for a few moments in water, they are then lightly stocked, and afterwards stretched and softened. They are sometimes stored in well-ventilated warehouses for some weeks to "age," which appears to effect a more immediate combination between the skin fibre and the tawing material. The skins can then be finished and dyed, after which they must be re-egged.

Alum-tawed leather does not resist the action of water for any great length of time, and by persistent washing, most of the alumina may be removed, so that alumed leathers are still available for the production of size and gelatin.

Chromium salts now occupy a very important position in the leather trade, since leather so tanned has been found to possess valuable properties not shared by any other leather. Chrome leathers, when rightly manufactured, are exceedingly soft, tough, and flexible, the tannage is very fast, and completely resistant to water, even at boiling temperature. Chrome leather is often spoken of as waterproof, but this is incorrect. The skin is porous, although the fibres themselves do not become wet. But actual waterproofness may be conferred on chrome leather by impregnating with fats and insoluble soaps. But when this is not done, it is perfectly permeable to air, and the statement so often made that chrome leather is unhealthy and hot to the feet is a mere prejudice, or due to the use of improperly manufactured chrome leather.

The first chrome process to obtain commercial success was that invented by Schultz in 1884. The process consists of first treating the prepared skins with a solution of about 5 per cent. of potassium bichromate, and $2\frac{1}{2}$ per cent. of hydrochloric acid reckoned on the weight of wet pelt. When the required quantity of chromic acid has been taken up, the skins are put into a solution of 10 or 12 per cent. of sodium thiosulphate, with sufficient commercial hydrochloric acid to convert the whole of the absorbed chromic acid into bluish-green chromic salt by reduction. The process is thus very simple in theory, but in practice considerable skill and knowledge are required to yield thoroughly satisfactory results.

In the first or chromic-acid bath, the chromic acid has no direct tanning effect on the skin, and is absorbed, as all acids are absorbed, by the gelatinous fibres. When the skins come out of the chrome bath the surplus bichromate solution must be removed by draining or by pressure. In the second bath it is probably best to use the full required quantity of thiosulphate first, adding sufficient acid to produce a decided evolution of sulphurous acid, and then add more acid in small quantities, so as to keep the bath in a constantly acid condition until the reduction is complete and the leather has become a uniform duck-egg green. When the reduction is complete, the skins are effectually tanned, but still retain an amount of free acid fixed in the fibres which would cause trouble in the finishing process, and probably produce shrinking and hardness in the finished leather, and which cannot be removed from the fibres by mere washing on account of the attraction that the fibres possess for acid. They must therefore be washed with warm or hot water, and then treated with a solution of 3 per cent. of borax to neutralise and remove the acid, the borax solution apparently removing not only the free acid, but most of that combined with the chromic oxide. The skins are then submitted to a further process called fat-liquoring, to lubricate the fibre and increase the softness and fulness of the leather. This fat liquor consists of a milky emulsion of soap and oil in water. A mixture of castor oil and castor-oil soap has been found most successful. About $1\frac{1}{2}$ per cent. of soap and $\frac{3}{4}$ of a per cent. of oil on the weight of wet pelt answers well. Before fat-liquoring, the skins, however, should be partially dried by pressing or by hanging in the air, and the fat-liquor must be used warm. The success of fat-liquoring depends on the fineness of the emulsion formed.

Martin Dennis was the first to introduce a commercial one-bath liquor on the English market. He obtained an English patent under the name of his agent, Gallagher. The liquor covered by this specification is made by dissolving precipitated chromium hydrate in hydrochloric acid to saturation, and then adding sodium carbonate to neutralise the required amount of acid, thus producing a suitable basic salt. A similar basic compound may also be obtained direct from bichromate by reducing it in the presence of "a limited calculated quantity of hydrochloric acid." With such liquors the process of chrome tannage is much simplified, and an even more satisfactory result at a lower cost may be obtained by using ordinary chrome alum suitably neutralised with sodium carbonate. The more completely the liquor is neutralised short of precipitation, the fuller and finer the leather it produces, and the addition of salt to the liquor tends to fineness, softness, and a thinner product. The pelt fixes the more basic salts of the solution most freely.

The results of all these one-bath methods are so certain and easy, once the proper conditions are understood, that it appears likely to ultimately supersede the two-bath process entirely. These chrome tannages must be followed by boraxing and fat-liquoring, as in the former two-bath process.

In chamoising, the sheep skin, after having been deprived of its wool by the fellmonger, is limed and split into two thicknesses, the "grain split" being used for the manufacture of thin fancy leathers used in bookbinding and portfolio work, while the flesh lining is used for "wash-leather." It is first drenched and then put into "stocks," and pounded till a part of the moisture is evaporated and the fibrous structure has become loose and open, sawdust generally being added to facilitate the process. Oil is now added in small quantities, generally cod liver oil, though on the Continent whale oil and other marine oils are frequently substituted. The oil is gradually absorbed by the skin, replacing the water which evaporates, the skin being occasionally hung up for a short time exposed to the air to facilitate the operation. When the skins have absorbed a sufficiency of oil they lose their limy odour, and acquire a peculiar mustard-like smell due to the oxidation of the oil. They are then loosely packed in boxes, where they heat rapidly, and must be taken out and exposed to the air to prevent overheating. Much pungent vapour of acrolein is given off, the skins when finished being a pronounced yellow. The excess of oil is removed by washing with a warm soda solution. In France, where the oxidation is much slower, the oil is less viscid, and a large portion of it can be removed by dipping the skins in hot water, and then wringing or hydraulic pressing. The oil pressed out in this way constitutes the pure "moellon dégras" or "première torse," which, when mixed with tallow and other cheap fats, constitutes the dégras of commerce. By the English process, washing out with soda, and afterwards acidifying, the product is then known as sod oil. The skins are then bleached in the sun, being moistened occasionally with an alkaline fat liquor, or by treatment with permanganate of potash, followed by washing in sulphurous or sulphuric acid, or by sodium peroxide.

The chemical explanation of the above process is not certain. The oils used are invariably drying or semi-drying oils. The oxidation undergone by oils is by no means a simple one, and varies in character with the conditions, and in most cases solid bodies as well as volatile aldehydes and ketones are produced by the breaking up of the hydrocarbon chain and the direct double linking of the separated fragment with oxygen. The glycerin also becomes dehydrated during the heating process, producing large quantities of pungent acrylic aldehyde or acrolein. Knapp supposed that the formation of oil leathers was sufficiently explained by the coating of the fine fibrils of the skin with the waterproof products of the oxidised oils. No doubt this action takes place, and is of importance, but it does not completely solve the problem, as is proved by the fact that wash-leather can be treated with warm alkaline lyes, in which these bodies are easily soluble, without losing its character.

It has long been known that formaldehyde had the power of rendering gelatinous fibres insoluble even in hot water. It appears that this power of hardening gelatinous fibres is a general one of the aldehyde class, and as considerable quantities of these are among the products of the oxidation of many oils, it may well be that the special action of drying oils is not due to the varnish-like coating which they produce on the fibre, but to the direct tanning action of aldehydes which are formed during their oxidation. Messrs. Pullman, of Godalming, indeed, have recently succeeded in producing, by the aid of aldehydes, leather which has all the good qualities of chamois leather, but in which no oil is used.

Crown or Helvetia leather, is made by a similar process. The hides, after being unhaired, are coated with a thick layer of a pasty mixture of barley meal or flour, milk, and soft fat; they are then introduced into a large drum, and after some time taken out, slightly dried, and given a second coating of the paste, and the process repeated several times. [Even the flour is not essential for the process, as leather equally tough, but not so full and plump, can be produced with fat alone.] The albuminous matter of the flour is drummed into the skin, and becomes fixed there by the same tawing or tanning action which converts skin itself into leather.

Klemm invented another sort of lace leather prior to "Crown" leather, in which the raw hide was first treated with alum and salt and then washed, after which it was treated with a fat and flour paste.

The vegetable tannins form a large class of bodies, varying very considerably in their chemical structure, but having in common the properties of precipitating gelatin from its solution, of forming dark-coloured compounds with ferric salts, and converting skin into leather. A curious point is, that even in the same plant different tannins may exist in different parts; thus, the tannin of the bark, the wood, the acorns and the galls of oak is distinctly different, although it is quite possible that all of them are mixtures. The tannins, therefore, fall into two great classes; those derived from protocatechuic acid, and which yield catechol on dry distillation, and which may therefore be called the catechol tannins, and those from gallic acid, which yield pyrogallol on heating, and may be called the pyrogallol tannins. Possibly tannins exist which contain both these groups at once. It is certain that there are catecholphloroglucinol tannins, containing both the dihydric phenol catechol, and the trihydric phenol, phloroglucinol. This difference in constitution corresponds to a marked difference in properties. The catechol tannins generally give green-blacks with ferric salts. Their infusions are precipitated by excess of bromine water, and, employed in tanning, or boiled with acids, or even alone, they give dark coloured, generally red, and difficultly soluble products which are deposited on the leather, as, for instance, with hemlock bark. The catecholphloroglucinol tannins, such as those of cutch and gambier, behave very similarly to ordinary catechol tannins. Pyrogallol tannins, on the other hand, give blue-blacks with ferric salts, no precipitate with bromine water, and usually a pale precipitate of ellagic acid with acids, and on the surface of the leather, constituting what tanners term "bloom." This deposit is not due to the decomposition of gallotannic acid, but to the presence, in larger or smaller proportions, of an allied tannin, ellagitannic acid, of which the constitution is imperfectly understood. Gallotannic acid itself gives no "bloom," though ellagic acid is easily formed from it by the action of dehydrating agents. The only tannin of which the structure is approximately understood is gallotannic acid, which was proved by Schiff to be a digallic acid; but even in this case it has been lately shown that Schiff's synthetic digallic acid is not absolutely identical with the natural product.

The precipitate which is formed when gelatin and tannin solutions are mixed is not of constant composition, but varies considerably, according to whether the gelatin or the tannin have been in excess at the moment of combination. Its composition is also altered by washing with hot water, so that it has not the characteristics of a definite chemical compound, but suggests rather the result of a chemical equilibrium, though no explanation on these lines has yet been attempted. It is possible that there may be more than one compound formed between the gelatin and the tannins, and that the observed irregularities of composition are due to the presence of two compounds in varying proportions.

The great changes which have taken place in tanning methods since the days of our forefathers have been in the first place mechanical. Much work which was formerly done by hand is now accomplished by steam power. In the second place, advantage has been taken of the vegetable products of other lands, richer in tanning matter than our oak bark, and therefore enabling leather to be more quickly produced by the use of stronger infusions, and, still more, by their systematic change and renewal.

Formerly oak bark was practically the only tanning material used in England, but, later, valonia, the acorn cup of an evergreen oak in Asia Minor and Greece, which contains about three times as much tannin as oak bark, has been much used. It produces a harder and heavier leather, owing to the presence of a large proportion of ellagitannic acid, which yields much of the white deposit known as "bloom." Another of the more recent materials is myrobalans, the dried fruit of a large Indian tree (*Terminalia chebula*). Akin to this, but yielding still lighter coloured, softer, and lighter weighing leather, is sumach, the leaf of the *Rhus coriaria*, of Sicily. The tannin of sumach is nearly pure gallotannic acid, allied with a colouring matter giving yellow dyes with alum and tin mordants. Divi-divi and algarobilla, the pods of South American trees, closely allied to logwood, are amongst the richest of natural tanning materials. All these materials contain tannins, mainly of the pyrogallol group, and to them one more may be added of great importance—the wood of the oak. It is now manufactured in Slavonia and in other parts into a commercial extract, the tannins being extracted from the wood shavings by hot water. The dark-coloured solutions are then brightened and partially decolorised by agitating and warming with dried blood or blood-albumin. They are then filtered, and the clear infusion is concentrated in vacuum pans until it contains from 25 to 30 per cent. of tanning matter. Another kindred industry is the manufacture of the extract from the Spanish chestnut, principally carried out in the south of France. The product differs but little from the oak wood in its tanning properties, and is so like it in appearance that it is frequently substituted by unscrupulous dealers.

Besides the tannins belonging to the pyrogallol group, there are the catechol tannins. These are largely found in the barks of larch and spruce fir, larch bark being used in Scotland for tanning sheep skins, while spruce bark is one of the most important materials in Eastern Germany and Austria. Of greater importance is the American hemlock spruce (*Tsuga* or *Abies Canadensis*), which is one of the principal tanning materials of North America. The bark of various trees of the mangrove family is now gradually finding its way into English yards. Quebracho, the very hard and heavy wood of a tree from the Argentine, belongs to the same class of tannins. Canaigre, the tuberous root of a large dock, is also a catechol tannin, and the various mimosas and acacias all also belong to the catechol group.

The modern tanning process consists in submitting the hides or skins, previously prepared by the methods of liming and bateing, to infusions of tanning materials, which are gradually increased in concentration as the process advances, and of which the strength is frequently maintained in the later stages by layers of ground tanning material dusted in between the leather.

The extraction of the tanning materials takes place in large vats or leaches, provided with a latticed or perforated false bottom to allow of drainage, and in the best yards these are generally connected, in series of six to ten pits, in such a way that the liquor from the bottom of the weakest flows by gravitation on to the top of the next stronger, forcing its liquor down through the false bottom and up a tube on to the top of the next, and so on. This process diminishes labour, and makes it possible to secure a much more constant and systematic change of liquor, which is of great importance, since the dissolved tannin in the material will only diffuse out into liquor weaker than itself, and no length of mere soaking in liquors which are not sufficiently changed will accomplish satisfactory exhaustion.

The use of heating is also of great service, hot liquors extracting more rapidly and bringing portions of the tannin into solution which cannot be extracted in the cold.

It has been shown by Parker and the author (J. Soc. Chem. Ind. 1895, 635, and 1898, 107) that each tanning material has an optimum temperature of extraction at which more tannin can be extracted than at any other. As a general rule, 60° C. can be used on the weaker and nearly exhausted leaches without any injury to colour.

The hides for sole leather are generally brought into the liquors still swollen with lime, and it is of essential importance that these first weak liquors should contain a sufficiency of weak vegetable acids, such as lactic and acetic, to neutralise and remove the lime. It will otherwise combine with the tannin on the surface of the hide, forming easier oxidisable compounds, which darken seriously on drying, and frequently make the grain brittle. In modern yards the hides are generally suspended in the liquor so as to expose their surfaces freely to its action. After the hides have been coloured in "suspenders," they are laid flat in pits, in which they are regularly handled. After some weeks of this treatment, through gradually increasing strengths of liquor, they are then placed in pits with stronger liquors, and with valonia or other tanning material, dusted between the hides. These are termed "layers." In these pits the hide is allowed to lie for longer periods, beginning with a week or ten days, and increasing to a month or six weeks. The leather is then washed free from loose bark, &c., partially dried, finished by rolling and other mechanical processes designed to render it solid and smooth.

The tannage of dressing leather differs but little in principle from that of sole leather. The hides and skins are freed from lime by bateing, puering, and drenching, which at the same time reduces the swelling of the fibres, and the skin gains in surface area while it loses in thickness.

It will be noticed that the whole process of tanning is one of diffusion, which, from the colloid character of both skin and tannin, is necessarily slow. Hides may be quickly tanned by treating the goods in a drum, in which they are continuously tumbled about. They are thus doubled, compressed, and relaxed, so that the liquor is, as it were, pumped through the spaces of the fibres, but is not materially assisted in its penetration of the fibres themselves, so that leather produced in this way tends to be rapidly and evenly tanned through, but without very complete tannage of the interior of the fibres themselves. Leathers tanned in this way are likely to be tough rather than solid. It is doubtful whether the very best class of sole leather can ever be produced by a quick process. A process of "dusting down" with solid materials for long periods, as in the ordinary sole-leather process, confers a sort of solidity which cannot be obtained by liquors alone.

Other processes of electric tanning have been patented, but as yet no very convincing proof has been given of their commercial success.

The finishing of sole leather is limited to "scouring" and compressing the surface with stones, brushes, and an implement called the "striking pin," and then submitting the material to heavy pressure under a brass roller. The softer leathers not only undergo mechanical treatment for the purpose of smoothing and stretching, but they must be "stuffed" or saturated with oils and fats to increase their resistance to water and to add to their flexibility. They are frequently dyed or stained, and submitted to mechanical processes to produce various forms of grain surface. The goods being first submitted to processes of "scouring," the thickness in many cases must be reduced or rendered uniform by "shaving." (The operation of splitting now often takes the place of shaving, especially with heavier leathers.) "Hand stuffing" is accomplished by covering the leather, which must be in a partially wet condition, with a thick layer of "dubbing," which is essentially a mixture of tallow and oil. "Drum-stuffing" has revolutionised many branches of the currying industry. For this process a drum is used, like an enormous barrel churn, the leather, in a suitably damp condition, being introduced into the hot apparatus, and the melted fats are introduced through the hollow axle of the drum, and in less than half an hour they are completely absorbed by the leather.

Patent or enamelled leather is produced by a "japan," of which the essential constituents are linseed oil and Prussian blue, boiled together to a viscous mass. The leather which is to be japanned is stretched on large boards, which are fitted to slide-like drawers into drying chambers, heated to 140°—160° F. After the first coating is dry, it is smoothed down with pumice before a second coat is applied. Frequently seven or more coatings are given, the final one being mixed with copal varnish to produce a more glossy surface.

The seal skin which is used for the manufacture of seal moroccos is not that of the known fur seal proper, but the coarser skin of certain allied species common in the Arctic regions.—J. G. P.

PATENTS.

Tanning Hides and Skins, Apparatus for Treating and. J. F. Jones and E. S. Clegg, London. Eng. Pat. 22,318, Oct. 24, 1898.

THE object of this invention is to provide cheap and efficient apparatus for the treatment and tanning of hides and skins of animals. The skins or hides are put in any suitable tank or pit, constructed of suitable material, in which the tanning or other liquid can be caused to circulate between the said hides or skins for the purpose of tanning them.

The patent also combines the arrangement of tubes or conduits, so constructed and arranged as to direct the tanning or other liquid between the hides or skins, and the special apparatus, consisting of a specially made tank, fitted with the necessary tubes, conduits, pumps, &c., for directing the desired flow of the tanning or other liquor that the circulation of the liquid can be reversed, and, in fact, can be made to flow in a horizontal direction or vertically, or at any inclination, over surfaces of the hides or skins.—J. G. P.

Tanning. J. V. Koch, Würtemburg. Eng. Pat. 24,844, Nov. 24, 1898.

POLISHED leather, brown and other kinds of leather, may be rapidly tanned by means of a combination of vegetable and chromium tanning, which consists in treating the raw hide successively in a solution of basic chrome alum, basic oxychloride of chromium, and vegetable tanning materials. 5 kilos. of chrome alum are dissolved in 15 litres of water, and decomposed by means of a solution of 2 kilos. of soda ash, dissolved in 5 litres of water. This mixture is gradually added into a vessel partially filled with water, at a temperature of from 30°—35° C., in which water about thirty cleansed hides, free from lime, are agitated for about four hours. The hides are then treated in like manner in a second bath, made up with 1 kilo. of chromic hydrate, dissolved in 5 litres of hydrochloric acid, and decomposed with sodium carbonate solution until basic oxychloride of chromium separates. The hides are then worked in this for an hour, and afterwards subjected to the action of any suitable vegetable tannage for a period of about six days. —J. G. P.

Waste Fish and other Offal [Glue, Oil, &c.], Apparatus for Treating and Drying. J. F. Johnson, London. Eng. Pat. 25,660, Dec. 5, 1898.

THIS apparatus consists of a digestor, steam jacketed or otherwise heated, having an axis or axes carrying stirring blades. It is also furnished with an oil-discharge pipe so that any oil separating may be displaced by water and carried off by this pipe. Glue is recovered from the residue, by evaporating the aqueous extracts. The apparatus has a man-hole at the top for charging, and a large discharge pipe at the bottom, through which the pulp material is passed out to the drying machines.—J. G. P.

Artificial Glue and Size, and Compounds for use in the Manufacture of Coated or Glazed Papers. T. A. Haynes, New Jersey, U.S.A. Eng. Pat. 2781, Feb. 7, 1899.

A GLUE or size is prepared from skimmed milk and incorporated with colour to form a stain. The process consists in the following steps:—Generating lactic acid in milk, allowing it to stand until thick, cutting the mass up small, whereby the casein will "form a hydrate," expressing the liquids from the solids of the hydrate, adding an alkali to the hydrate, and kneading and working the same, and finally successively varying the temperature until all the gas has worked off. A new product is described, formed of glue or size, "made from milk in combination with a proportion of wax." The milk is heated to about 170° F., and after some hours it becomes thick. The thick substance is cut in pieces and the liquid drawn off; the solid substance is then kneaded in a wooden trough with carbonate of soda and borax. The process is repeated until the mass becomes sticky and glutinous. This is now heated in a suitable jacketed vessel at 170°; the temperature is lowered and heightened until the gas has been expelled.—J. G. P.

Horn Cuttings, Horn Shavings, Powdered Horn, or the like, Process for the Production of a Homogeneous Horn Substance from. F. W. Goldby, London. From J. G. Bierich, Menkenhof, Russia. Eng. Pat. 6402, March 24, 1899.

THE distinguishing feature of this process is, that the material to be worked up, after being cleaned thoroughly, is mixed with linseed oil or glycerin, and subjected to a temperature of about 100° C. or more, for about 40 minutes, at a pressure of about 200 or more atmospheres, air being excluded. The time and temperature are regulated according to the material to be treated, or whether it is desired to produce a hard, brittle substance, or a soft, elastic substance. The horn substance produced by this process can be worked up like natural horn.—J. G. P.

XV.—MANURES, Etc.

Phosphate Manures, Value of Lime Compounds in. O. Bottcher. Deut. Landw. Presse. 1899, No. 91, 222.

BASIC slags contain, at the present time, as much total lime (50 per cent.) as formerly, and a not inconsiderable portion of the lime is in the free state. By digesting basic slag in 2 per cent. citric acid for half an hour, 42—45 per cent. of lime was dissolved, and in 12 hours 45—52 per cent. was dissolved. Basic slag is therefore not of less value as a lime manure than formerly, and the amount of free lime is generally only slightly lower.

The amount of lime is not, however, a criterion of value, either in the case of basic slag or superphosphate, the value of which depends on the phosphoric acid alone. There is no doubt that the phosphoric acid in basic slag is cheaper than that in superphosphate.—N. H. J. M.

Ground Thomas Slag, Valuation of. F. W. Dafert. Zeits. landw. Vers.-Wes. Öst. **2**, 467—476; Chem. Centr. 1899, **2**, [15], 727.

THE author has, in a previous paper (Zeits. landw. Vers.-Wes. Öst. **2**, 55), protested against the use of the so-called "citrate solubility" as a measure of the agricultural value of a Thomas slag, and has, at the same time, drawn attention to the analytical inconveniences involved when the sale of Thomas slag is undertaken on a basis of the amount of "citrate soluble" P_2O_5 present in it. By means of analyses which have been made during a period of four years, the author sought to ascertain whether the "citrate soluble" P_2O_5 may be regarded as a constant factor. He finds that the amount of "citrate soluble" P_2O_5 is, sometimes, as much as 3 per cent. higher in one case than in another, and finally arrives at the opinion that such an analytical method is of no practical value, so long as its execution makes claims on personal skill which even the trained analyst cannot satisfy.—A. S.

Potassium Chloride Manure, Effect of, on Sugar Beet Production. J. Stoklasa. Blät. f. Zuckerrübenbau, 1899, No. 8, 113.

APPLICATION of potassium chloride (about 100 kilos. per hectare), in addition to superphosphate (250 kilos.), and nitrate of soda (200 kilos.), increased the yield of roots without diminishing the amount of sugar. If the amount of potassium chloride is increased, there is a further increase in the yield of roots, but the percentage of sugar is reduced. The beneficial effect of potassium chloride, applied for roots, extends to the next crop, especially when this is barley.—N. H. J. M.

Sodium Nitrate [Manures], Toxic Properties of Perchlorates in. De Caluwe. Bull. Assoc. Belge des Chim. **12**, [8—9], 363.

THE author finds that, in point of injurious influence on plant life, sodium perchlorate is more active than the corresponding potassium salt, and this, in turn, than potassium chlorate, rye and maize being the most susceptible of cultivated plants. The influence of these salts on the weight of plant produced per unit area of surface (1 sq. metre) treated with 150 grms. of sodium nitrate is shown in a table, the figures receding from 6·7 kilos. in the case of pure nitrate to 3·35 kilos. in the case of nitrate containing 2·67 per cent. of $NaClO_4$, whilst 4—5 per cent. of the latter proved fatal in all cases.—C. S.

Chili Saltpetre, Poisonous Action of. F. Krüger and G. Bergu. Centr. Bakt. 1898, **4**, 673—683.

THE results of pot and field experiments in which wheat, rye, oats, and barley were manured with different amounts of ordinary Chili saltpetre containing perchlorate, of pure nitrate of soda, and of pure nitrate in conjunction with various amounts of pure perchlorate, showed that large quantities of Chili saltpetre are injurious to plants, and that potassium perchlorate is highly poisonous. The peculiar bending of plants manured with nitrate containing perchlorate is also produced by nitrate alone; but perchlorate is the only substance which has the effect of preventing the points of the leaves from breaking through the sheaths. —N. H. J. M.

PATENT.

Destroying the Weeds of Cereal Fields, such as the Wild Mustard, Wild Radish, and others of the Charlock Family. C. D. Abel, London. From the Bayerische Aktiengesellschaft fur Chemische und Landwirtschaftlich Chemische Fabrikate, of Heufeld, Oberbayern, Germany. Eng. Pat. 14,084, July 7, 1899.

FIELD weeds, not of the *gramineæ* order—especially those of the charlock family, such as *Sinapis Arvensis* (wild mustard) and *Raphanus Raphanstrum* (wild radish)—are destroyed by sprinkling the fields, either when dew is falling or after rain, with powdered anhydrous ferrous sulphate, preferably diluted with gypsum, bone-meal, or similar material. 5 to 10 kilos. of a mixture containing 15 per cent. of ferrous sulphate are sprinkled over an area of about 120 sq. yards. The fine powder settles only upon the broad-leaved charlock weeds, and, becoming dissolved, destroys the vegetable protoplasm, after which it becomes oxidised and consequently innocuous.—L. A.

XVI.—SUGAR, STARCH, GUM, Etc.

Sugars in the Pure State, Process for Preparation and Separation of. O. Ruff and G. Ollendorff. Ber. 1899, **32**, [16], 3234—3237.

SUGARS may be quantitatively regenerated from their phenylhydrazones either by Fischer's method with hydrochloric acid or by Herzfeld's method with benzaldehyde. In their investigations, the authors turned their attention to the action of benzylphenylhydrazine (Lobry de Bruyn and A. van Ekenstein. Rec. trav. chim. Pays. Bas. **15**, (97, 227) on these sugars. This base is distinguished by its easy preparation, and by readily yielding hydrazones which are only slightly soluble. The authors prefer to prepare the hydrazones in neutral alcoholic solution rather than in presence of acetic acid. The aqueous solution of the sugar is gently warmed with a solution of the base in absolute alcohol, and water is added to incipient precipitation. The benzylphenylhydrazones of *l*-xylose and *d*-arabinose are described, the former melting at 99° C. (corr.), and easily soluble in alcohol and ether, the latter melting at 174° C., and insoluble in 75 per cent. alcohol. The insolubility of the latter in alcohol of this strength enables the ready separation of arabinose from mixtures with xylose, glucose, and galactose, whose hydrazones are all soluble. It is noted that the *d*-glucose compound melts at 165° C. (corr.), and not at 150° C., as described by De Bruyn and van Ekenstein. The authors found that benzaldehyde was not a good reagent for the regeneration of the sugars from the benzylphenylhydrazones, but, taking advantage of the observation that the formaldehyde compound is insoluble in water, they arrived at the following method, yielding excellent results:—1 grm. of benzylphenylhydrazone is dissolved in a test tube in 2 c.c. or 3 c.c. of 30—40 per cent. freshly distilled formaldehyde solution, and heated on the water-bath. After 5—30 minutes the solution becomes cloudy, and the formaldehyde hydrazone finally separates out as a heavy oil. This is removed by extraction with ether and the aqueous solution repeatedly evaporated on the water-bath, until all the formaldehyde has been removed, or, where possible, the last traces of metaformaldehyde are removed by solution of the syrup in absolute alcohol. The sugar is then crystallised from the colourless syrup by sowing a crystal. This method shows no advantage over Herzfeld's in the case of simple phenylhydrazones, but is most satisfactory with the substituted compounds. Formaldehydebenzylphenylhydrazone is obtained as a yellow oil which solidifies after a time and crystallises from alcohol in long white needles, m. p. 41° C. It is soluble in almost all solvents except water.—J. F. B.

Beetroot, Arabic Acid from. E. Votocek and J. Sebor. Zeitschr. Zuckerind. Böhmen. 1899, **24**, [1], 1—15.

The product which is formed on boiling beetroot pulp with an alkaline liquid, and hitherto named arabic acid, is not a pure substance. This is shown by the different rotatory powers of various preparations, and the very fluctuating quantities of the separate products of decomposition which may be quantitatively estimated, namely, arabinose and galactose, and, finally, by the fact that on acetylation and subsequent saponification, the original substance is not reproduced, but others of much higher lævo-rotation and containing a different proportion of arabinose- and galactose-forming groups.

The so-called arabic acid from beetroot pulp is a neutral mixture. As Herzfeld found, only traces of soda are required for neutralisation; from 0·4 to 0·64 grm. of NaOH to 100 grms. of substance. It is not hydrolysed, as the glucoside acids are, according to E. Fischer, into a hexose and a hexonic acid, no acid constituent being detected in the products of hydrolysis.

It may contain dextrose groups, for, after removing arabinose from the products of hydrolysis, a very pure glucosazone (m. p. 208° C.) was obtained, and the polarisation of the mixed sugars also points to the presence of *d*-glucose.

Degener found that with arabic acid from gum arabic the original lævo-rotation was changed into a marked dextro-rotation by basic lead acetate. The author finds that this reagent increases the lævo-rotation of arabic acid from beetroot pulp, but the increase is less than found by Kovdl.

—L. J. de W.

Grevillea robusta, Analysis of the Gum of. Roeser and Puaux. J. Pharm. Chim. 1899, Series 6, **10**, [9], 398—400.

Grevillea robusta is an Australian tree which has been acclimatised on the North African littoral. The gum which exudes is white and soft when fresh, but assumes a yellow or reddish colour and hardens on keeping. It has no odour, but its taste is astringent, with a disagreeable aftertaste. It is difficult to pulverise, but if heated at 100° C. it becomes friable. It gives a viscous solution in water, from which it is precipitated by 95 per cent. alcohol. It yields a slight cloudiness with neutral lead acetate, and is precipitated by ammoniacal basic lead acetate. It is not precipitated by ferric chloride, but the colour of the mixture increases on warming and pales again when cold. It reduces cupric potassium solutions feebly, giving a greyish-blue precipitate. With a dilute solution of copper sulphate, after addition of caustic potash, a bluish-green solution is obtained. Dilute alkalis in dilute solutions give a rose coloration. Analyses according to Martina's methods showed:—

——	Crude Gum.	Dried Gum.	Gum precipitated by 95 per Cent. Alcohol.
Moisture	15·530	..	..
Ash	2·660	3·150	2·715
Lime	1·356	1·596	0·864
Mucic acid	19·934	23·600	26·660
Galactose	26·578	31·470	35·460
Furfural	11·262	13·333	20·645
Pentose	22·524	26·666	41·290
Total glucoses	52·377	62·000	78·180
Galactose and pentose	49·102	58·136	76·750

—J. F. B.

Reducing Sugars, New Method of Estimating. P. Chapelle. J. Pharm. Chim. 1899, **10**, [9], 395.

See under XXIII., *page* 1159.

Carob Seeds, The Sugars produced from, during Germination. E. Bourquelot and H. Hérissey. Comptes Rend. **129**, [16], 614.

See under XXIV., *page* 1161.

Oxidation and Hydrolysis of Organic Substances, Simultaneity of, under the Action of Free Oxygen and Sunlight. Berthelot. Comptes Rend. **129**, [17], 627.

See under XXIV., *page* 1162.

Sugar Syrups, Notes on the Analysis of some. A. K. Miller and J. P. Potts.

See page 1091.

PATENT.

Ammonia and its Salts, A Process of and Apparatus for obtaining from the Spent Liquor of Molasses in Sugar Factories, and from Vinasse. H. Fischer, Pecek, Bohemia. Eng. Pat. 15,815, Aug. 2, 1899.

The spent liquor or vinasse is thickened in the usual way, is introduced into gutter-shaped, closed retorts, formed in batteries in a kiln, heated primarily by a gas furnace, and afterwards by combustible gases derived from the charge, the temperature being allowed to rise slowly from 200° C. up to, but not exceeding, 500° C. Each retort is provided with a screw, which is rotated opposite ways successively, so as to serve as an agitator; but when the process is completed it is rotated one way only, to serve as a conveyor screw for discharging the contents. The gases and vapour evolved during the distillation are conducted into a receiver in which the tar separates, and thence to a condenser in which ammoniacal products are collected, while the permanent gases pass to a gasometer from which the furnaces, of which there is a separate one for each retort, are supplied. Evaporating vessels are built into the flue, to utilise waste heat in concentrating the liquors. The fixed products discharged from the retorts burn to a white ash on the exposed heap.—E. S.

XVII.—BREWING, WINES, SPIRITS, Etc.

Reserve Albumin. J. Grüss. Woch. für Brau. 1899, **16**, [41], 532—533.

Albumin which is found under the aleurone layer of the barleycorn, may be characterised as reserve albumin. The quantity of this varies; it is situated in the peripheral cells of the endosperm, where it takes the place of starch; towards the interior of the endosperm it gradually decreases. The starch lies in a honeycomb framework of plasma, the elements of which are classed together under the name of "histological albumin"; this, however, is not chemically nor morphologically homogeneous. Reserve albumin undergoes peptonisation during germination. This change progresses in the form of branching canals, and, after solution of the hydrolytic products, a sponge-like mass of intact substance remains between. Finally, a general softening takes place, and the whole substance becomes gelatinous.

A barley with a high proportion of reserve albumin always gives a steely malt on kilning, especially hard if peptonisation has not been carried far. On kilning with a large supply of air, a steely corn is obtained of similar structure and transformation as by drying at the ordinary temperature. The transformation of reserve albumin does not always follow the same course. If a corn, rich in reserve albumin and with high moisture, be kilned quickly at a high temperature without air, part of the albumin is rendered completely insoluble. The products of peptonisation of the reserve albumin may soak into the mealy part of the endosperm and become dried to a hard steely mass, enclosing the starch granules. This is traversed by fissures and cracks, which can often be observed as streaks under the microscope; when the soluble proteïd has been removed, the starch granules stand out more clearly.—J. F. B.

Grain, Estimation of Moisture in. J. F. Hoffmann. Woch. für Brau. 1899, **16**, [44], 569—574, and [45], 585—588.

The object of the author was to test the methods applicable for control purposes on the large scale, and capable of giving results within 1 per cent. in a minimum of time. Drying without heat in a desiccator is scarcely practicable; only after two days did two samples of barley with very different percentages of moisture attain a normal state of moisture within the required limits. The present methods of moisture estimation in drying ovens can be readily modified for the practical scale by drying larger quantities (25 grms.), spread out over as large an area as possible. Twenty-five grms. can be dried in an ordinary drying oven in one hour, including weighings, and the limits of error can be reduced to 0·5 per cent. The necessary temperature of 110° C. has no charring influence on the meal in the short time, provided that trays of non-conducting material, such as paper or card, be used. The method of procedure is as follows:—The oven is brought to a constant temperature of 110° C., two lots of 25 grms. each of freshly ground cereal are weighed out and spread in a thin layer on smooth cardboard trays or shovels. They are placed in the oven, and the temperature, which sinks after this operation, again rises to above 100° C. in about half an hour. After 35 minutes, one of the samples is removed, brushed into a weighing bottle and weighed; the second sample is heated a little longer and weighed as a control. In the case of grain which contains over 20 per cent. of moisture, the entire corns must be dried to a known extent before grinding. The aqueous vapour produced by the combustion of the gas below the oven must not be allowed to enter the oven with the current of air used for drying the grain; the process is considerably lengthened if this be allowed. A current of heated, filtered air is of great service in the drying process, and arrangements are described for obtaining this; the beneficial action of aëration decreases with the thickness of the layer of meal. Where gas is not obtainable, the spirit Bunsen burners are preferred by the author, as giving constant temperatures with easy regulation. Two methods are described as being specially suitable for works where there is no laboratory. (*a.*) Knöfler's drying apparatus, which consists of a number of annular trays vertically attached to each other, the whole basket being suspended from the arm of a lever balance in a drying chamber, consisting of an annular space heated by steam at five atmospheres pressure; large quantities (300 grms.) can be dried in one hour with sufficient accuracy without the use of a precision balance. (*b.*) The relative moisture of a sample of grain can be estimated with fair accuracy by taking the weight of 1,000 corns at different periods of the drying operation on the large scale. An apparatus is described for rapidly counting the corns of cereals; as this depends on the uniform size of the corns, a method is given for correcting the error in the sifting operation in proportion to the shrinkage with loss of moisture.—J. F. B.

Oxidising Ferments of the Vine. C. Cornu. J. Pharm. Chim. 1899, Series 6, **10**, [8], 342—343.

Sections cut from the various parts of the vines and dipped in alcoholic tincture of guaiacum resin gave a blue coloration, indicating the presence of oxydases. This coloration appeared principally in the cortical parenchyma, medullary rays, and liber, but not in the woody tissue. The same sections, if previously soaked for some time in alcohol, or heated at 90° C., no longer gave the reaction. The sap of the vine, after treatment with chloroform, turned guaiacum solution blue, and solutions of diphenols brown, but had no action after boiling. The author concludes that these oxydising enzymes are of the class which convey oxygen directly (aëroxydases), and that the activity of the ferment is variable, according to the nature of the vine stock and the season.—J. F. B.

Yeast Preparation [Distillery]. H. Lange, Zeits. Spiritusind. 1899, **22**, [46], 422—423.

The vessels and pipes used in the preparation of the preliminary yeast mash must be kept scrupulously clean. A concentrated yeast mash is better than a weak one; the former favours the acid production, economises space, and gives a purer fermentation. Experience shows that from 22° to 24° Bg. is the most convenient strength. Yeast prepared in the old-fashioned, thin, green-malt mashes is not suitable for the modern thick mashes. Failure and sluggishness of the yeast is almost unknown in the case of yeast prepared in concentrated mashes. Concentrated mashes can be finished off at a higher temperature, without fear of destroying the diastase; thus better sterilisation is obtained. The final temperature of the yeast mash may very well be 65° C., whilst with mouldy raw materials 67°—70° C. is recommended. Higher temperatures than the latter point must, however, be avoided, or else the favourable lactic bacteria will be destroyed. The acidification of the yeast mash by lactic fermentation is a very delicate operation, over which many distillers come to grief. A case is quoted where the initial acidity before pitching, equal to 0·8 normal alkali, rose during fermentation to 1·9, whereas 0·2 is the largest increase which should take place. The fault was found to be due to the low initial acidity, which was caused by the distiller conducting the lactic fermentation at 75° C., under the impression that the fermentation would be purer, whereas the bacteria were disabled at this high temperature. Lactic fermentation should be conducted at 50°—58° C., with good stirring, and should be stopped by heating up to 75° C. The acid mash must never be allowed to remain after cooling, before adding the yeast, as it is liable to infection if the yeast be not sown at once. When fermented, the ripened yeast culture should be pitched without delay into the main mash, which should be ready to receive it, otherwise acetic bacteria will become active. In answer to the question, When may the yeast culture be considered ripe? the author remarks that attenuation should be carried as far as it will go, in order to obtain the protection of the maximum proportion of alcohol. It is less harmful to use the culture too old than too young, but the critical point must not be overpassed, or the activity of the yeast allowed to die down; quiescence means danger.—J. F. B.

Yeast Preparation, Frequent Errors in. E. Tietze. Zeits. Spiritusind. 1899, **22**, [48], 442.

The author remarks on the paper by Lange (see preceding abstract), and says that most of the difficulties in the distillery are traceable to the yeast room. In Hungary they use large yeast vats of 600—800 litres capacity, in which it is easier to maintain constant temperature conditions than in the small German vessels. By conducting the acidification at 49° C. for 18 hours, and subsequently heating up to 70° C., an acidity of 2·6 was obtained, and the fermentation was perfectly satisfactory. The author does not approve of thick, pasty, yeast cultures; they should be mobile. With potatoes rich in starch, the mash may be made up to 22°—24 Bg. With potatoes poor in starch, a mash of 18 Bg. gave good results, but directly it was attempted to work with more concentrated liquors bad consequences ensued. It is a great mistake to throw away the yeast too frequently, or to strengthen it with pressed yeast; it is also most inadvisable to import fresh yeast from other distilleries. The only rational method is to buy a pure culture of yeast, "Race II.," and one or two bottles of lactic acid, and cultivate a stock yeast under the conditions prevailing on the spot; any initial irregularities, such as excessive foaming, &c., will soon disappear, as the yeast becomes adapted to its surroundings. "Race II." is as yet unsurpassed. With regard to the question of ripeness of the yeast culture, the author has known cases where an unripe culture, taken at only 10 attenuation, has given better results than when used fully ripe. Given a good malt, and provided the acidification temperature does not fall below 49° C., it is not necessary to kill the lactic ferment after acidification, but if this be desirable for any reason, a temperature of 70° C. must not be exceeded. The mother yeast should always be replanted with as little material as possible, as, if it is not quite pure, a large volume of planting yeast means transference of a large quantity of impurities.—J. F. B.

Yeast, The Generation Period of various Species of. D. P. Hoyer. Centralbl. Bakt. 1899, **5**, 703—705.

The following table sets forth the generation period of different species of yeast, *i.e.*, the time which is required at certain temperatures for one cell to be born from a mother-cell—one generation:—

Species.	Generation Period.			
	13° C.		25° C.	
	Hours	Min.	Hours	Min.
S. cerevisiæ, top fermentation	7	47	4	33
Do. bottom	8	56	4	28
Do. Saaz. bottom	7	48	4	23
Do. Frohberg, bottom	7	21	4	18
S. ellipsoideus I., Hansen	9	4	6	12
Do. II., Hansen	8	40	6	9
S. Pasteurianus I.	6	6	±3	37
Do. II.	8	45	5	12
Do. III.	8	39	6	8
S. anomalus	5	12	..	
S. Ludwigii	8	10	..	
S. membranæfaciens	7	1	5	13
Ss. Pombe	..		6	4
Mucoderma cerevisiæ	7	24	±3	20
S. apiculatus	4	45	..	
Torula alba	6	31	..	

—J. F. B.

Yeast, Treatment of, with Tartaric Acid, to prevent Sarcina Infection. Deutsche Bierbrauer; La Bière. **7**, [10], 152.

The employment of tartaric acid alone as a preventive of sarcina is considered as ineffective, and as increasing the evil by attacking the healthy yeast as well as the extraneous organisms. Thus, in the case of a yeast recognised as containing sarcina, and, for the purpose of eliminating the latter, sterilised by washing in boiling water, and afterwards cooled to 39° F., sieved, made up to a thick pap, and treated for eight hours with 0·5 per cent. of tartaric acid, the fermentation, in wort pitched with the treated yeast, set in five hours earlier than usual, but the head, at the time of racking, was fragmentary in character, and was found to contain a very large number of moribund yeast cells. The beer clarified badly and exhibited an unpleasant flavour, from which it is concluded that the treatment did not properly purify the yeast.—C. S.

Buchner's Expressed Extract of Yeast. A. Wróblewski. Centr.-Bl. f. Physiol. **13**, 284—297. Chem. Centr. 1899, **2**, [14], 672.

The author has continued his investigation of the expressed extract of commercial yeast (see this Journal, 1899, 156 and 598). He states that no real difference could be observed between the composition and properties of the extracts from commercial yeast and from a pure culture of wine yeast. As regards the chemical properties of zymase, which the author studied by means of an expressed extract of a pure-culture beer yeast, it was found that formalin destroyed the fermenting power of the extract. Hydroxylamine hydrochloride at a concentration of 0·07 per cent. exerted a slight restraining action on the zymase; larger quantities completely suppressed its fermenting power. From experiments with pure hydrochloric acid, the author concludes that the hydroxylamine hydrochloride reacts with certain constituents of the extract, with the liberation of free acid, which acts upon the zymase.

In a medium containing nitrite, the extract exerted a denitrifying action, developing no carbon dioxide, but nitrogen. The author is of opinion that the reduction of nitrites taking place in the soil is a purely chemical change, depending upon the action of the former on amido compounds, &c. Very small quantities of nitrite are capable of destroying the life of the yeast, so that it is scarcely possible to classify the latter as a denitrifying organism. Nitrates were not reduced either by the extract or by the living yeast cells; they act on the fermenting power of the extract like common salt and ammonium sulphate, arresting it only when present in large quantities. An addition of small quantities of neutral salts appears to increase the fermenting power both of the expressed extract and of the living yeast. Alcohol, in large quantities, stops fermentation, probably by precipitation of the proteïn matter of the extract.

The invertase is only mechanically carried down to a small extent by saturation of the extract with ammonium sulphate; the greater part remains in the filter. It can, accordingly, only belong to the group of peptone and proteose substances. The invertase was purified by three fractional precipitations with acetic acid, further purification being attained by means of fractional precipitation with alcohol from the acetic acid solution. The acetic acid had no injurious effect on the invertase; on the contrary, it even strengthened the inverting power. Even 4 per cent. acetic acid did not act very injuriously; 0·28 per cent. hydrochloric acid had no appreciable effect. The invertase is attacked neither by the proteolytic enzyme present in the extract nor by trypsin. Alkalis have an injurious action. Alcohol, after acting a long time, destroys the inverting power.

The author concludes that quite other properties must be ascribed to zymase than are possessed by enzymes. Zymase belongs to the group of proteoses and peptones, from which enzymes are at once excluded, by reason of the fact that they cannot pass through an earthenware cell. The action of zymase is stopped by the addition of 1·5 per cent. of a neutral salt; it acts only in concentrated solutions. Its fermenting power is rapidly checked by dilution of the extract, whilst enzymes act better in dilute solutions. According to the author, zymase stands nearer to the protoplasma than to the enzymes, and its behaviour towards neutral salts and dilution points to osmotic phenomena. It is, in fact, a ferment, but not an enzyme.—A. S.

Malt, Characteristics of a Highly Diastatic. Lange. Zeits. Spiritusind. 1899, **22**, [44], 403—409.

Results have shown that the light, small, highly nitrogenous varieties of barley are better adapted for yielding a highly diastatic malt than the heavy, full, brewing barleys. Delbrück and Hayduck showed that, other conditions being equal, the diastatic power of a malt was greater, the greater the dry substance of the rootlet combined with a well-developed plumule. Powerful malt is prepared, not by forcing germination with excessive moisture and high temperature, but at a moderate temperature, with good aëration, not too much moisture, and, above all, giving it a long time on the floor. The internal processes of transformation of the endosperm and of the proteids proceed side by side, and should appear to have been conducted to their full limits. The mealy part of the corn should be friable between the fingers. But the only safe indication is obtained by a chemical estimation of the diastatic power.—J. F. B.

Starch, Saccharification of. Pottevin. Ann. Inst. Pasteur, **13**, 665—688; Chem. Centr. 1899, **2**, [14], 644.

The author separated the various products one from another by fractional precipitation with alcohol. The hydrolysis of the starch was carried out by precipitated diastase. The results of the experiments indicate that there are two perfectly distinct phases in the conversion of starch into sugar:—(1) starch into dextrin; and (2) dextrin into sugar; and that each phase corresponds to a particular property of the diastase; in fact the latter may be regarded as a mixture of a dextrin-forming and a sugar-forming enzyme. The starch granules are not uniform, even after the formation of paste. The less coherent particles are converted into dextrin and sugar rapidly, the more coherent particles slowly. The latter yield the stable dextrin, which is always present at the end of the saccharification.—A. S.

Maltodextrin. H. Pottevin. Ann. de L'Inst. Pasteur, 1899, **13**, 728; through Chem. Zeit. Rep. 1891, 311.

According to the present author, the substance called "maltodextrin" by Brown and Morris is no true compound, but simply a mixture of maltose and dextrin. The difference in behaviour between artificially prepared mixtures of dextrin with maltose and maltodextrin itself as towards diastase, alcohol as a solvent, and ferments, is due simply to differences in the nature of the dextrin, which was examined separately from that which was present in the maltodextrin. Lintner and Düll have already shown that maltodextrin is broken up into its constituents by alcohol; by fract ional precipitation, Pottevin has also separated it. Brown a Morris' statement that maltodextrin dialyses as such is said to be incorrect; and their argument as to its individuality, which is based on its total decomposition by diastase at 60° C., is, the author believes, proved to be invalid by his previous work on the dextrins.—F. H. L.

Brewers' Pitch with High Percentage of Mineral Constituents. J. Brand. Zeits. für d. ges. Brauw. **22**, [30], 397—398.

A sample of so-called "Manitpech," of Hungarian origin, examined by the author, gave the following results:—

Colour, dark chocolate brown; consistency, very brittle, easily reduced to a loose powder; dull, crystalline fracture. When heated to 150°—180° C., a brownish-red powder accompanied by metallic lustrous scales of micaceous iron ore—amounting to 32·12 per cent. of the total weight of the pitch—rapidly subsided. In practice, this mineral matter would quickly collect on the bottom of the pitch kettle and lead to overheating, the evil being even greater when used in pitching machines; and the presence of this sediment would give rise to difficulties in unpitching the casks. The preparation is therefore regarded as worthless for the purpose in view.—C. S.

Brewers' Pitch, Solvent Action of, on Iron. J. Brand. Zeits. für d. ges. Brauw. **22**, [32], 419—420.

The deepening in colour of brewers' pitch when heated in iron vessels, is mainly due to attack on the metal with liberation of hydrogen and formation of iron salts. It is therefore undesirable to leave the pitch in iron vessels for long periods.—C. S.

Wort, The Influence of the Method of Mashing on the Composition of the. W. Loe. International Congress for Applied Chemistry at Vienna, 1898; through Zeits. angew. Chem. 1899 [46], 1110—1111.

The author mashed malt in two ways:—(1.) Slow mashing, started at 17°·5 C., heated to 45° C. in 10 minutes, kept at 45° C. for one hour, temperature raised to 80° C. in 20 minutes, kept at 80° C. for 25 minutes. (2.) Rapid mashing, started at 80° C., temperature of mixture 60° C., heated up to 80° C. in 10 minutes, kept at 80° C. for 25 minutes, saccharification complete. The wort from the rapid mashing did not clarify or filter well. Analysis showed that the wort of the slow mashing contained 8·78 per cent. of maltose more, 4·92 per cent. of dextrin less, and 3·08 per cent. of total proteïds more that the wort from the rapid mashing calculated on the malt dry substance. Further analyses were made of the two worts, before and after boiling with hops, with special regard to the proteïd constituents. The total proteïds, the true proteïn, peptone I. (by means of cupric hydroxide), peptone II. (by means of tannin), and the proteïd equivalent of the amide nitrogen were determined. Boiling with hops causes a loss of proteïds (peptone II.) by precipitation with the hop tannin, but, on the other hand, alkaloidal and amine basic bodies are extracted from the hops, concealing the loss of peptone II. and increasing the amide nitrogen. Aldehydic bitter principles with cupric reducing properties are also extracted, apparently increasing the proportion of maltose and decreasing the dextrin. The apparent effect of boiling the rapidly mashed wort with hops was almost nothing: there was merely a slight increase in the total nitrogen, whilst the effect on the slowly mashed wort was normal in spite of the shorter time of boiling. In fact, it would seem that the prolonged boiling of the rapidly mashed wort with hops had a destructive effect on the cupric reducing aldehydic bodies, and that the apparent proportion of dextrin was increased. The conclusion drawn is, that the superior retention of foam by rapidly mashed worts is a property of the larger proportion of dextrin, and not of nitrogenous constituents, since slowly mashed worts, which do not hold the foam so well, contain a higher proportion of nitrogenous bodies, and no qualitative differences explaining the foam retention as a property of nitrogenous constituents could be detected.—J. F. B.

Beer Head, Yellow Coloration of. E. Prior. Allgem. Anzeig. für Brau. **15**, [45], 1750—1751.

The author's experiments on the colouring effect on head of additions of colour- and caramel-malts to ordinary Bavarian malt show that, in worts of 18—20 degrees Balling, pitched with pure yeast, the presence of 2½ per cent. of colour malt gave a very decided yellow coloration to the head. Caramel malt produced a less decided effect, and both were surpassed by "caramelised colour malt," 5 per cent. of which developed in the head an intense brownish-yellow, and 10 per cent. a deep yellow-brown colour.—C. S.

Attenuation [Brewing], Preventing Excessive. Oesterr. Brau.- u. Hopfen-Zeit.; Allgem. Anzeig. für Brau. **15**, [43], 1669.

The cause may reside in an unsuitable adjustment of the relative temperatures of the fermenting room and storage cellar (for secondary fermentation), so that the yeast is unduly checked in the former and stimulated in the latter. Slow-cured malt with a high percentage of readily fermentable matter may also lead to the same result, and in such case a change of yeast and accelerated boiling of the mash will afford a remedy. Thus, in a case where the apparent attenuation in the primary fermentation reached 70 per cent.—the limit required for final attenuation—a suitable change of yeast and the modified treatment given below reduced it to 50 per cent., the limit of final attenuation being then only reached after two months' secondary fermentation in the storage cellar.

The first mash was raised to boiling in 45—50 mins., the second in 40 mins., and the third—also a "thick" mash—in 25 mins. at the outside. After leaving at rest 20 mins., the mass was sparged with water at 161°—167° F., run off the cooler at 122° F. and pitched, with 0·75 per cent. (by volume) of yeast, at 43° F., the temperature being then allowed to increase to 47½° F., but re-cooled during the two last days to 41°—43° F.—C. S.

Beer, Influence of Mycoderma on. H. Will. Zeits. für d. ges. Brauw. **22**, [30], 391—397; [31], 407—410; [33], 435—438.

The author's previous experience, that mycoderma is more frequently met with in top-fermentation beers than in those of the bottom-fermentation type, was confirmed and explained by the experiments detailed in the present paper, which show that the higher temperature and greater exposure to air in the former case are favourable to the development of this class of organism.

The decolorising action of mycoderma on beer wort is considerable, under favourable circumstances, the reduction attaining 0·6—0·7 on the Lintner dilution-colorimeter scale in seven days. When tried in conjunction with top-fermentation yeast the extra decolorisation due to the action of mycoderma, as compared with that produced by the yeast alone, amounts to 0·4—0·5, whilst in the parallel case with bottom-fermentation yeast the difference is only 0·1—0·3. In fermentations with top- and bottom-fermentation yeast, but carried on at a lower temperature (9° C.), the difference in either case, however, was the same, *viz.*, 0·1, owing to the slow rate of reproduction of mycoderma under these conditions. It also appears that vigorous primary and secondary fermentations tend to keep this organism in check.

A decidedly mouldy flavour and smell is developed in beer by mycoderma, especially when the proportion of yeast present is low; but under converse conditions the organism soon dies if air be excluded and the temperature kept low. This indicates the desirability of filling the bottles as full as possible, in the case of bottled beers. No turbidity was noticed in any of the experiments.

In point of acid production the species of mycoderma examined, gave results the maximum figures of which, expressed in c.c. of $N/5\ Ba(OH)_2$, per 100 c.c. of wort, were: at the end of 3 days, 23; 10 days, 98; and 20 days, 145, the original acidity being 7. The acid resembled acetic acid in odour at first, but afterwards the smell was more like that of roasted apples; the taste, also, differed from acetic acid. The acidity is probably the cause of the decolorising action on the wort. Negative results only were obtained in the tests made to ascertain the alcohol-producing capacity of this micro-organism.

The heat-resisting capacity was tested in neutral water, acid wort, sauerkraut water, and beer, with the result that all the cells were killed at 55° in water, at 65° in wort, and 50° in beer, and at 60° in sauerkraut water. The results, however, were irregular, some of the cells perishing at lower temperatures, the older individuals being probably more strongly developed than the others in regard to cell-membrane.—C. S.

Alcohols, Toximetry of, by the Plasmolytic Method. A. J. J. Vandewelde. Bull. Assoc. Belge des Chim. **13**, [8—9], 364—365.

The author determined the critical strength of various alcohols, *i.e.*, the degree of dilution at which plasmolysis of the vegetable cell—such as the epidermal cells of the red Brunswick onion—still occurs in presence of a plasmolysing salt. The scale of toxicity is as follows:—

Methyl alcohol, 1; Ethyl alcohol, 1½; Isopropyl alcohol, 3; Normal propyl alcohol, 5; Isobutyl alcohol, 7½; Amyl alcohol, 14.

The normal alcohols are more active than the side-chain alcohols, and the energy of all is doubled when they are dissolved in ethyl alcohol. No appreciable influence on the results is exerted by the nature of the salt employed.

—C. S.

Vacuum Fermentation. K. Michel. Zeits. für d. ges. Brauw. **22**, [33], 438—441; [34], 452—455.

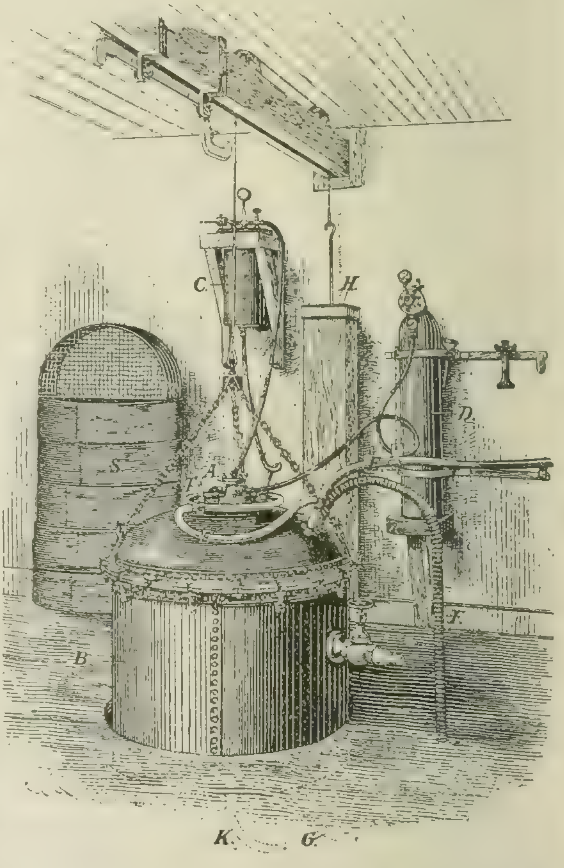
A description and estimate of the cost of the Pfaudler vacuum fermentation plant are given, and the following advantages are said to result from the adoption of the process: increased cleanliness, owing to the use of enamelled steel vats; absence of contact with air, except sterilised air, for purposes of aëration; removal of carbon dioxide during primary fermentation; employment of a temperature of 44°—48° F. in the fermenting room, and of 48½° F. in the wort; great acceleration of the fermentation process, which is completed in seven days, the beer being then equal in point of maturity to ordinary beer three months old; maintenance of purity and high energy in the yeast, the rate of reproduction, also, being under control; uniform quality of beer at all seasons. Furthermore, the carbon dioxide can be collected, and a portion utilised in carbonating the beer, under a pressure of about 10 atmospheres, by which means the beer can be ready for sale in about 11 days from the time of mashing; if clarifying shavings are used, about double this time will be required.

The author also describes his own modification of this process, to adapt it to German conditions, and the results of his comparative investigations lead him to the conclusion that fermentation in open tuns can be accelerated to just the same extent as in the vacuum process, without there being any difference in the quality or maturity of the beer in either case, the sole advantage of the latter method being the economy of space ensured by the larger vessels employed. The time required for maturing the beer increases with the degree of hopping practised, since though attenuation can be increased by aëration, the development of the fine flavour of strongly hopped beer is a function of time.—C. S.

Pasteurising Apparatus, A New. L. Aubry. Zeits. für d. ges. Brauw. **22**, [31], 410—413.

The principal advantage claimed for the Rockström pasteurising apparatus is, that the increased pressure of the gas imprisoned in the beer during the operation is automatically counterbalanced, thus preventing breakage of bottles and loss of condition.

The apparatus (see figure) consists of—A, an automatic pressure regulator, comprising a valve case under which is situated a vessel of the size of a beer bottle, the two being hermetically separated by a steel membrane attached to the valve. An empty space below the membrane corresponds to the space between the cork and the beer in an ordinary bottle.



B, a circular covered vessel fitted with racks for the beer bottles, as well as with a steam coil at the bottom and a cooling coil at the top, in addition to air and water taps, &c.

C, a smaller vessel fitted with a gauge, safety valve, &c., and serving to take up the excess of water from B.

H, a counterpoise attached to the lid of B.

The position of the apparatus when in working order is shown in the drawing, D being a gas cylinder for producing pressure.

The corks are protected, whilst the apparatus is at work, by truncated cones of thin metal, sufficiently heavy to overcome the weight of the water to be driven out.

The small vessel in the pressure regulator A being filled with beer, the bottles are placed in position in the vessel B, the lid of which is then screwed down, and the vessel itself filled with water, as are also the tube holding the thermometer and the pipe leading to A. Steam is admitted through the coil until the desired temperature is attained, whereupon the cooling liquid is turned on, and, when the temperature is sufficiently reduced, the bottles are taken out and replaced by a fresh charge.

The automatic pressure regulator A acts in the following manner:—The temperature of the beer in the small vessel being raised concurrently with that in the vessel B, the resulting pressure forces the membrane upwards and opens a valve, which admits the pressure medium and closes again when equality of pressure is restored. Thus, a counter pressure, balancing the internal pressure in the bottles, is developed in B.—C. S.

Spirits, Cleansing of, by Treatment with Cold Air. R. C. Scott.

See page 1082.

PATENTS.

Spirits, Process for Solidifying. R. Fallnicht, Altona, Germany. Eng. Pat. 15,030, Oct. 14, 1898.

THE process claimed consists in heating 100 parts of spirits to 65° C. and mixing 5 parts of these with 3 parts of a solution of sodium hydrate (1 in 3) at the same temperature, stirring this mixture with 5 parts of melted stearic acid, and then adding the remaining 95 parts of heated spirits.—J. F. B.

Non-Intoxicating Drinks, Compounds for Making. J. H. Broderick, Northfield, Worcestershire. Eng. Pat. 25,149, Nov. 29, 1898.

THIS is an improvement on Eng. Pat. 15,004, 1896 (this Journal, 1897, 627), and provides for the preparation of a compound for making a fermented non-intoxicating drink in imitation of stout or ale, consisting of hops, roasted malts, or malt flour, non-fermentable sweetening agent, or saccharin and fermentable sugar, with or without the addition of caramel. The ingredients are thoroughly incorporated, the hops being added last, and the mixture compressed into cakes.—J. F. B.

Carbonating Beers, Apparatus for. H. Vuylsteke, Brussels. Eng. Pat. 25,505, Dec. 2, 1898.

THE claims relate to a means for spreading or spraying beers into a cylinder, breaking up such beers by sinuous travel around spheres in a lower vessel into which carbon dioxide or an equivalent gas is distributed, with an upward motion for charging the beer with gas, while travelling downwards in a finely divided or broken condition, and the re-collection in a pipe for stowage in a vessel previous to bottling. The combination of three vessels, superposed, in two of which beer is sprayed and broken up, whilst being brought into contact with the gas, and is subsequently collected in the lowest without losing its aërated qualities, is also claimed.
J. F. B.

Manufacture of Cider, Retarding the Fermentation of the Apple Juice. J. Murray, London; communicated by Soc. An. Matierès Colorantes et Produits Chimiques de St. Denis and A. Rosenstiehl, Paris. Eng. Pat. 25,974, Dec. 8, 1898.

THE invention is based on the fact that yeast, when cultivated in apple juice, becomes weakened in fermentative properties with each succeeding generation. The claims are for producing a slow fermentation by first sterilising the apple juice and then fermenting it with an enfeebled yeast; also by fermenting it with a proportion of an active yeast, insufficient for complete fermentation, so that the later stages of the process are carried out by subsequent enfeebled generations. A third claim provides for first incompletely sterilising the apple juice, and then fermenting it with the yeast it still contains, or else by either of the yeasts described above. The object in retarding the fermentation is to prevent the process from being completed too soon, in which case the cider would become flat and dull by the time it was required for consumption.—J. F. B.

Saccharine Liquors [Worts, &c.], Purifying and Decolorising. E. Luck and S. G. Luck, Southwark. Eng. Pat. 26,475, Dec. 14, 1898.

THE inventors claim the use of calcium or barium permanganate for the purpose of decolorising worts, cane or starch glucose liquors. The amount of permanganate required depends on the quantity of impurities, and averages about 4 lb. per 1,000 galls. The deposit is then removed by filtration.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Effervescing Lemonades [Limonades Champagnisées]. Frehse. J. Pharm. Chim. 1899, 6th series, **10**, [8], 347—348.

HITHERTO the artificial permanent foam on some brands of lemonade has been obtained by means of saponine, but a new means has recently been introduced, namely, extract of liquorice root or glycyrrhizin. The characteristics of this substance are its precipitation in the cold by hydrochloric acid or the chlorides of sodium, calcium, or iron. In the presence of other matters it is difficult to detect this substance in the above way, and the lemonade should be treated with basic lead acetate. The precipitate is filtered, washed, and decomposed by hydrogen sulphide. In presence of the tartaric acid of the lemonade, the glycyrrhizin remains with the lead sulphide on filtration; this is washed with acidulated water and then rapidly with pure water. The precipitate is extracted with alcohol and finally with ammoniacal alcohol. The alcoholic filtrates are evaporated, and the glycyrrhizin is obtained as a yellow substance which is readily identified.—J. F. B.

Milk Preservatives, Alkali Chromates as, Detection of. A. Leys. J. Pharm. Chim. 1899, **10**, [8], 337—340.

THE use of alkali chromates as preservatives of milk has largely increased during the previous year; the most common proportion is 1 part per 100,000. The chromates remain in the ash, but the above proportion is insufficient to impart any yellow colour to the latter. When moistened with sulphuric acid, a reddish-yellow coloration of chromic acid, or, owing to the presence of chlorides, red fumes of chromium chloride, are developed. 100—150 c.c. of milk are evaporated and incinerated, the ash is extracted with water, and the filtrate is tested in three ways, two of which indicate the presence of an oxidising agent, and the other of chromium.

If chromates are present:—

(1.) A dilute solution of indigo carmine in presence of strong hydrochloric acid is decolorised by the extract.

(2.) A mixture of aniline and toluidine acetates in solution is oxidised on boiling for two or three minutes with the extract, giving a coloration of magenta.

(3.) If the extract be acidified with a little dilute sulphuric acid, and two or three drops of hydrogen peroxide be added, a fugitive blue coloration is developed, due to the formation of perchromic acid.—J. F. B.

"*Kola*" *Milk and Condensed* "*Kola*" *Milk.* L. Bernegau. Zeits. Untersuchung. Nahr. u. Genussm. 1899, **10**, 797.

The author draws attention to the preparation of milk products containing kola-nut. These preparations are made with whole or skimmed milk, the process of manufacture being as follows:—One pound by weight of kola-nut meal is allowed to soak overnight in 5 litres of cold water. Next morning it is boiled for a quarter of an hour, and the fluid is pressed out from the solid portion, filtered and sterilised. This extract is then added to 97·5 litres of skimmed milk and the mixture is filled into suitable tin cans for use. The finished product may be condensed for export. Medicinal properties are claimed for "kola milk," especially in cases of phthisis.—W. P. S.

Butter-Fat, Chemical Composition of. II. C. A. Browne, jun. J. Amer. Chem. Soc. 1899, **21**, [10], 807. (This Journal, 1899, 780.)

See under XII., *page* 1132.

PATENT.

Meat Extract, Soluble Albuminous. O. Siebold, Liepzig, Germany. Eng. Pat. 61, Jan. 2, 1899.

"PROCESS for the production of a savoury albuminous meat extract, in which the acid of a meat extract is neutralised . . . . . and intimately mixed with soluble albumin brought into the swollen condition by alkalis . . . . ."—A. C. W.

(*B.*)—SANITATION; WATER PURIFICATION.

Fluorine, Occurrence of, in Mineral Waters. C. Lepierre. Bull. Soc. Chim. 1899, **21**, 863—864.

FLUORIDES exist in many mineral waters, though only, for the most part, in traces. Certain waters, however, contain readily determinable quantities of fluorides; the most remarkable instance of this being the mineral water of Gerez, in the north of Portugal, which is largely used for liver complaints. This water contains only some 300 mgrms. of solids to the litre, of which about 25 mgrms. consists of alkali fluorides, probably that of sodium. Fluorides in water may be detected by (1) the etching of glass by the fumes produced when the solid residue from the water is heated with sulphuric acid; (2) in presence of much silica, the formation and decomposition by water of silicon fluoride; (3) the methods of Lannes and of Carnot; (4) the formation of crystals of sodium silicofluoride, the appearance of which under the microscope is characteristic. —J. T. D.

Sterilising Water by Ozone. E. Andreoli. Elect. Rev. 1899, **44**, 749—750.

THE efficiency of ozone as a germicide has been recognised in a report by certain French doctors upon the experiments on the sterilisation of water by ozone carried out by Marmier and Abraham at Lille. With regard to the question of cost, the author considers that Marmier's estimate of 2 centimes per cubic metre is too high, and in order to throw further light on the subject, he has made a series of experiments in London, measuring the consumption of ozone in terms of electrical energy. The apparatus employed consisted of a small Andreoli ozoniser worked at a tension of 3,500 volts, a Root's blower for forcing the ozonised air through the water, and five tanks in which the absorption of ozone by the water took place.

The apparatus allowed of the treatment of 440 galls. of water per hour. The results obtained, with expenditures of electrical energy varying from 138 to 316 watts per cubic metre of water, are set out in a table.

The author concludes, from his experiments upon Thames water, that complete sterilisation of water drawn from the river at specially selected spots could be obtained with an expenditure of electrical energy equal to 100-watt-hours per cubic metre of water. (See also this Journal, 1890, 851.) —A. S.

Water, Purification of, by Ozone. van Ermengem and L. Gerard. Zeits. für das ges. Brauw. **22**, [23], 304—305.

THE germicide properties and chemical action of ozone, generated by the Tindal process, on various waters are given in a series of tables, a typical example being that of water from the Bruges Canal, which gave the following results:—

——	Before Treating	After Treating.
No. of colonies per 1 c.c.	1,430,000	Nil
Organic matter	0·102	0·055
Chlorine	0·208	0·184
Ammonia, as salts	0·9	0·1
,, as protein	0·31	0·18
Nitrites	Traces	..
Nitrates	..	Traces
Residue on evaporation	0·696	0·736
Loss on incineration	0·108	0·080
Flavour	Decidedly muddy	Good
Odour	,, peaty	Nil
Colour	Dirty green to brown.	Colourless to greenish-red.

The operation is complete in four to eight minutes, and only 100 watts are consumed per 1 cubic metre. The quantity of ozone (4·3 grms. per 1 cubic metre) in the air employed is regarded as sufficient to ensure thorough sterilisation.—C. S.

Water, Biochemical Purification of. Tixier. J. Pharm. Chim. 1899, **10**, [7], 297—300.

THE author points out that the use of potassium or calcium permanganates in the purification of water has not been successful owing to the impurities (free alkali) left after the treatment, rendering the water unsuitable for drinking purposes.

To obviate this, he advocates the use of aluminium permanganate in conjunction with barium permanganate in varying proportions. In the case of waters not containing calcium sulphate, the proportion of barium should be small, and the main reaction would be—

$$Al_2(Mn_2O_8)_3 = Al_2O_3 + 3Mn_2O_3 + O_{12}.$$

But with selenitic waters more of the barium salt would be required, and the reactions would be—

$$CaSO_4 + BaMn_2O_8 = BaSO_4 + CaMn_2O_8;$$
$$CaMn_2O_8 + Al_2(Mn_2O_8)_3 = CaOAl_2O_3 + 4Mn_2O_3 + O_{16}.$$

Owing to the instability of aluminium permanganate, the reaction takes place rapidly and in the cold, so that the insipidity due to the removal of the dissolved gas on boiling is obviated.

The results of a series of experiments with more or less impure samples of water of different origin are given in tabular form in the paper. The reagent used consisted of a solution of the two permanganates of sp. gr. 35° B., containing 209 grms. of permanganic acid neutralised by barium and aluminium hydroxides in such proportion that the resulting dry salt contained 7 per cent. of alumina (Al_2O_3) (the normal salt $Al_2(Mn_2O_8)_3$ containing 13·41 per cent. of alumina). This reagent was diluted with nine volumes of distilled water, and the diluted liquid added to the water to be purified in the proportion of from 2 to 82 drops, according to the degree of impurity. In each instance the water was decolorised and disinfected 24 hours after treatment, and the addition of one drop of the dilute reagent to the filtrate produced a permanent pink tint.

For the purification of water in general for drinking purposes, the author recommends adding the dilute reagent drop by drop to the hot liquid until a permanent pink coloration is obtained. The proportional amount thus found in a preliminary test is added to the bulk of the water in the cold, and, after standing for 24 hours, the liquid is decanted on to a carbon or other filter. When the water is not of a selenitic nature, the reagent should contain but little barium, so that after the reaction an aluminate of barium results, which is insoluble in the presence of the carbon dioxide dissolved in the water.—C. A. M.

Crude Sewage, Bacterial Treatment of. Second Report to the London County Council by Dr. Clowes and Dr. Houston. (For abstract of First Report, see this Journal, 1899, 862.)

THIS report, consisting of 21 foolscap pages of print, 15 diagrams, eight photographed plates of bacteria, &c., and numerous tables, describes the results obtained by the intermittent bacterial treatment of crude London sewage in experimental coke-beds at the Crossness outfall station, during a period of about 10 months extending from April 22, 1898, to February 18, 1899.

The gas-coke used was broken into pieces of uniform size, about that of a walnut. The crude sewage before treatment was roughly screened, and, whilst containing all the suspended matter usually termed "sludge," had been freed from the larger matter usually described as "filth," and from coarse sand and road detritus. The treatment consisted in running this screened sewage into the coke-bed from above until the coke was just submerged, allowing to rest for about three hours, then slowly drawing off the liquid from below, and finally allowing the coke-bed to remain empty for 7—8 hours previous to refilling. Once a week the surface of the bed was raked over to a depth of several inches.

The coke-beds hitherto used, respectively 4 ft. and 6 ft. in depth, have been found to remove the whole of the suspended matter from the sewage, and an average of 51·3 per cent. of the dissolved oxidisable and putrescent matters (measured by the oxygen absorbed from permanganate in four hours at 80° F.); the effluent, when kept either in closed or in open vessels, has remained free from objectionable odour, and gold fish, roach, dace, and perch have lived in it for months. The coke, after 12 months' use, shows no tendency to become foul, but the fragments of coke have become superficially coated with a layer of soft matter, consisting chiefly of vegetable tissue from the sewage, which has reduced the effective capacity from 50 to 33 per cent. of the whole volume of the bed. The maximum amount of sewage which can be thus purified per unit area of coke-bed has not yet been ascertained. Experiments still in progress promise to show that the depth of coke can be increased to at least 13 ft., and that an acre of coke-bed will then purify fully 3½ millions of gallons of sewage per day. Experiments are also in progress to ascertain whether the diminution of the effective capacity of the coke-beds continues. Up to February 18th, the 4-ft. coke-bed had been filled with sewage 339 times, and had removed from the sewage an amount of solid matter which, it is estimated, would have formed sufficient sludge to fill the coke-bed tank to a depth of 2¾ ft.

The results obtained by the bacteriological examination of the effluent have shown that the coke treatment does not by any means remove the bacteria from the crude sewage, an average of 6,140,000 microbes per 1 c.c. of crude sewage being reduced by the 4-ft. coke-bed to an average of 4,437,500 per 1 c.c. of effluent, or a reduction of only 27·7 per cent. The presence of many of these bacteria may, however, be not only unobjectionable, but actually necessary to complete the purification of the effluent when it has flowed into the river. Of greater importance is the fact that those bacteria the presence of which in drinking water might be regarded as objectionable, such as *B. coli*, spores of *B. enteritides sporogenes*, &c., seem to pass through the coke-beds in undiminished numbers.

The *general conclusion* to be drawn from these experiments are, "that neither on chemical, nor possibly on bacteriological grounds, can any serious objection be raised to the introduction of the effluent from the coke-beds into a portion of the river Thames which is cut off by locks from the intakes of the water companies, and the water from which is not employed for drinking purposes, and cannot be used for drinking on account of its 'brackish' nature. The effluent certainly will not cause any deposit upon the river bed, and will even tend to render the turbid water of the lower river more clear and transparent. At the same time, the liquid discharged from the outfall into the river will be sweet, and entirely free from smell. Further, it will carry into the river the bacteria necessary for completing its own purification in contact with the aerated river water, and under no conditions can it therefore become foul after it has mingled with the stream. The effluent will in no way interfere with fish-life in the stream."

The bacterial process presents the following advantages over the present process of chemical precipitation and sedimentation:—

(*a.*) It requires no chemicals.

(*b.*) It produces no offensive sludge, but only a deposit of sand and vegetable tissue, which is free from odour.

(*c.*) It removes the whole of the suspended matter, instead of only about 80·0 per cent. thereof.

(*d.*) It effects the removal of 51·3 per cent. of the dissolved oxidisable and putrescible matter, as compared with the removal of 17 per cent. only, effected by the present chemical treatment.

(*e.*) Further, the resultant liquid is entirely free from objectionable smell, and does not become foul when it is kept; it further maintains the life of fish."—L. A.

Sewage Treatment by Coke. F. Clowes. Read before the British Assoc. Eng. and Mining J. 1899, **74**, [1900], 878.

See previous abstract.

Sewage and Water, Improved Methods for the Purification of, as shown in the Operation of the Municipal Plant at Reading, Pa. J. J. Deery. J. Franklin Inst. **148**, [4], 1899, 279.

The author discusses a scheme for the purification of the water supply of Philadelphia, based upon filtration, aeration, and exposure to sunlight. The water from the pumping mains would be received into a series of distributors exposed to light and air. Passing over the edges in thin films, it would fall upon splash plates, and thence flow to suspended screening floors of coke breeze supported between gratings and freely exposed to a current of air. In passing through the screening floors, the larger particles of suspended matter might be expected to be removed, as well as from 25 to 30 per cent. of all bacteria. After percolating through the coke, the water would drop on to a collecting floor, and from thence flow to sand filter-beds. Upon leaving the filter-beds, it would fall a distance of 10 ft. to a collecting floor, and then flow through pipes into the reservoir. The sand would be cleared for use over again by baking it and blowing away the fine dust. It is expected that 98 per cent. of all suspended matter and bacteria would be finally removed, and that the few bacteria remaining would die in the purified water.—H. H. B. S.

PATENTS.

Purifying Water. J. O. Kröhnke, Hamburg, Germany. Eng. Pat. 19,379, Sept. 26, 1899.

Water is clarified, decolorised, and purified from iron by the addition to it of suitable known chemicals, such as iron salts, aluminium salts, or magnesium salts, together with chalk. By the reaction of the latter with the metallic salt, well-pronounced flakes are formed, and the use of lime, excess of which in drinking water is objectionable, is avoided.

—L. A.

Sewage, Treatment or Purification of, and Apparatus therefor. C. A. Atkinson, Liverpool. Eng. Pat. 25,383, Dec. 1, 1898.

For the bacterial treatment of sewage, the treating tanks are made wedge-shaped, and are arranged in circles radiating round a central chamber. An inner circle consists of tanks containing coarse material, and an outer circle of tanks filled with finer material. The roughly strained sewage is distributed from the central chamber to each tank of the inner circle in rotation, remains there for two hours, passes thence into a tank of the outer circle, where it again rests for two hours, and finally flows on to land or elsewhere. The working of the entire plant is controlled automatically by valves operated by the flow of the sewage, which is fed continuously into the central chamber.—L. A.

Sewage and like Liquids, Method of and Apparatus for the Treatment of. E. W. Ives, Littleover, Derby. Eng. Pat. 19,411, Sept. 27, 1899.

Two small chambers are constructed in connection with the tank described in Eng. Pat. 16,034 of 1896 (this Journal, 1896, 733), one of which contains a bucket and the other the orifice of an outlet-pipe closed by a valve. The bucket and the valve are connected by a chain passing over two pulleys. When the water has risen through the filter, it overflows partly through a small pipe into the first chamber, filling the bucket and causing it to descend and raise the valve in the second chamber. This discharges the overflow from the tank at a level below the filter, and causes the latter to empty and become aerated afresh. The descent of the bucket to the bottom of its chamber discharges it. The valve in the second chamber then falls, again closing the orifice of the lower overflow pipe and causing the water to again rise through the filter.—L. A.

(*C.*)—DISINFECTANTS.

Tobacco Juice [*Insecticide*] *in France, Uses of.* J. Soc. Arts, 1899, **47**, [2451], 901.

The article used in France is manufactured by the tobacco monopoly in Paris and is sold as "tobacco juice, rich in nicotine and guaranteed." It is said to possess the following advantages: (1.) It is free from all matter susceptible of fermentation and keeps for an indefinite period if in closed vessels. (2.) It contains no resinous matter, and is almost transparent, consequently it does not injure or clog the spraying machines, and does not stain plants or flowers, or the wool of sheep. (3.) It has a government guarantee as to the proportion of nicotine it contains, which never varies. The amount of nicotine is claimed to be 5—6 times that contained in ordinary tobacco juice. For spraying purposes the juice is diluted with 100 parts of water per 1 part of juice. For fumigating hot-houses, a mixture of 1 part of juice and 5 parts of water is sprayed on to heated bricks or iron plates.

As a wash for cattle, the juice is mixed in the proportion of 1 part to 20 of water. The mixture should not be used as a general bath, but applied gradually on limited surfaces, and it should not be brought in contact with sores or erosions of any kind. It is said that the efficacy of these mixtures is greatly increased by adding 100 grms. of soda crystals to each litre of diluted juice. Cases are cited in which tobacco juice has been successfully employed against parasitic diseases of different plants.—A. S.

Ozone, Production of, in the Decomposition of Water by Fluorine. H. Moissan. Comptes Rend. **129**, [16], 570—573.

Fluorine, generated in a copper vessel, was passed by means of a narrow platinum tube into a small quantity of water kept at the freezing point, and the gases evolved were collected in a round-bottomed flask. When the air was completely displaced from the flask, the ozone present was determined by acidified potassium iodide solution and standard thiosulphate. After 30 minutes continuance of the stream of fluorine (at a rate of about 3 litres per hour), the gas evolved contained 14·39 per cent. of ozone by volume. If the temperature be allowed to rise, or the stream of gas be too slow, the yield of ozone is diminished. The ozone so formed is quite free from oxides of nitrogen, and as the electrolytic preparation of fluorine, though a delicate operation, is not costly, the method may possibly serve to produce ozone for some of its technological applications.

—J. T. D.

XIX.—PAPER, PASTEBOARD, Etc.

Waste Materials from Paper Mills, Nature and Composition of. R. C. Menzies and J. Elington Aitken.

See page 1097.

PATENTS.

Yarn, Paper, Cloth, or other Fabrics, by Means of Chemical Solutions or other Liquids, Machinery for the Continuous Treatment of. B. G. Ermen, Manchester, Eng. Pat. 23,325, Nov. 5, 1898.

See under V., *page* 1119.

Machinery or Apparatus for Making or Treating Paper Pulp. A. Masson and R. Scott, Surrey. Eng. Pat. 26,501, Dec. 15, 1898.

This claim is for an invention to enable the treatment of esparto, wood, and other pulps to be continuously carried out by automatic means, thereby avoiding the customary handling of the materials between the successive operations. This is effected by a combination of a potcher or potchers, bleaching towers, washing potcher, beating engines, and means of circulating the pulp from the potchers to the bleaching towers. From the bleaching towers the pulp is automatically conveyed to the washing potcher, and thence to the beating engine.—J. L. B.

Liquors Resulting from the Manufacture of Cellulose or Fibres by the Sulphite Process, Treating, in order to obtain Useful Products therefrom. C. D. Ekman, London, Eng. Pat. 189, Jan. 4, 1899.

Sulphite liquor is heated with zinc oxide in excess, until it becomes alkaline in reaction. The liquor is cleared by settling and filtration, and is "evaporated," preferably in vacuo. Or a zinc salt may be added to the sulphite liquor, which is heated in an agitator tank with a steam lead coil, and soda ash is added. The concentrated liquid has properties like those of dextrin, and may be used for sizing or stiffening purposes.—E. S.

Invisible Characters on Paper or the Like, and Showing also if they have been rendered Visible, Process for Writing and Printing. E. Kretschman, Hanover. Eng. Pat. 6727, March 28, 1899.

The paper or other material is treated with a solution of chloride of cobalt or other haloid salt of cobalt, and then written upon with a solution of sodium chloride. In order to prove if documents have been tampered with, certain signs are made with a sympathetic ink, as, for example, with a mixture of resorcinol and para-toluidine dissolved in sulphuric acid. This solution produces pale, red, or light yellow lines, which become black or brown when heated.

—J. L. B.

Rag Engines, Impt. in, also Applicable to Washing, Mixing, and Dyeing Vats for Paper Manufacture. K. Hromadink, Bavaria. Eng. Pat. 18,487, Sept. 13, 1899.

The patentee claims the use of "a conical wheel," provided with oblique blades, in combination with a rag engine, or mixing, washing, or dyeing vats, for the manufacture of paper material, so as to draw in the materials at the smaller end of the cone and expel them at the larger end, and thus propel and mix the pulp circulating through the rag engine or vat.—J. L. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

Methyl Alcohol, Furfural, and Diacetyl; Presence of, in Caraway "Runnings." Schimmel's Semi-Annual Report. Leipsic. Oct. 1899, 11—12.

The first runnings of the water during the process of distilling caraway oil from the seeds, are found, as is the case with cloves, to contain methyl alcohol and furfural. In both cases, the methyl alcohol is coloured intensely yellow, and cannot be purified by fractionation. When this yellow methyl alcohol is treated with phenylhydrazine, and the alcohol is distilled off, diacetylosazone is obtained; and when it is treated with hydroxylamine it yields diacetyldioxime. The yellow body is therefore considered to be diacetyl.—J. O. B.

Nitrous Ether, Preparation of Spirit of. J. Feil. Pharm. J. 1899, **63**, [1529], 363.

The following method of preparation of nitrous ether is stated to be simple, to only require about 15—20 minutes, and to give a larger yield (75 per cent.) than any other process:—30 grms. of sodium nitrite and 300 grms. of alcohol are placed in a litre flask with a doubly perforated cork or rubber stopper, carrying a stoppered funnel containing 20 grms. of sulphuric acid, and a glass tube connected with an upright condenser. The mixture of nitrite and alcohol is heated to incipient boiling, the flame removed, and the sulphuric acid slowly added; after action has ceased, heat is again applied for a moment or two and then withdrawn. The contents of the flask are allowed to cool, filtered through a well-covered funnel, and the filtrate made up to 450 grms. with alcohol.—A. S.

Fluoroform, Preparation of. Valentiner and Schwarz. Ger. Pat. 105,916; through Zeits. angew. Chem. 1899, [46], 1113.

A mixture of equal parts of iodoform and silver fluoride are intimately mixed with sand and heated in a flask on the water bath. The reaction begins at about 40° C., and proceeds quite regularly without further application of heat. The gaseous fluoroform passes through a system of washing vessels filled with alcohol, in which it is freed from iodine compounds, and then through another series containing cuprous chloride to remove carbonic oxide. The yield of purified fluoroform is nearly quantitative, the admixture of sand allowing the reaction to be perfectly controlled.

—J. F. B.

Calcium Glycerophosphate, Medicinal Preparations of. P. Carles. Journ. Pharm. Chim. 1899, **10**, [7], 307—308.

The calcium salt is generally regarded as the most suitable compound of glycerin and phosphoric acid for medicinal purposes, and is usually given in the form of a powder. Since, however, there are cases in which it is advisable to administer the drug in a liquid form, the author gives the following method of preparing an acid solution. Ten grms. of the normal calcium glycerophosphate are treated with 80 c.c. of distilled water at 40° to 50° C., and mixed with a solution of 2·5 to 3 grms. of crystallised oxalic acid in 10 c.c. of boiling water. After an interval of from 15 minutes to 2 hours, the mixed liquid is filtered, 5 c.c. of cherry-laurel water added, and the filtrate and washings made up to 100 c.c. The oxalic acid used may be replaced by 2·7 to 3 grms. of tartaric acid.

For the preparation of a syrup it is recommended that 100 grms. of the above solution be mixed with 160 grms. of sugar, and when the latter has dissolved, to filter if necessary.

A glycerophosphate wine can be prepared by treating 10 grms. of normal calcium glycerophosphate with 750 grms. of the wine, adding a solution of 2·7 to 3 grms. of tartaric acid in 250 grms. of the wine, and filtering after the lapse of several hours. A corresponding amount of oxalic acid may be used in place of the tartaric acid, in which case the subsequent slow deposition of potassium bitartrate is avoided. This wine is said to keep well.—C. A. M.

Phenacetine. G. Cohn. Annalen, **309**, [1 and 2], 233—238.

The anilides are generally hydrolysed by treatment with concentrated sulphuric acid. Acetanilide is an exception, it dissolves in the cold without alteration, but by heating for 4—5 hours it is almost completely converted into sulphanilic acid, no aniline being formed. Phenacetine is readily sulphonated by heating with three parts of strong sulphuric acid for 1—2 hours. On diluting and adding salt, the sodium phenacetine sulphonate crystallises out,

$$C_2H_3O.NH.C_6H_3(OC_2H_5)SO_3Na[NH:OC_2H_5:SO_3Na = 1:4:5].$$

If phenacetine sulphonic acid be boiled with strong caustic soda for some minutes, and the solution be then diluted and acidified, phenetidine sulphonic acid separates in needles.

Benzoylphenetidine and lactophenine yield sulphonic acids in a similar manner to phenacetine.—A. C. W.

Solanaceæ, Some Alkaloids of the. O. Hesse. Annalen, 309, [1 and 2], 75—94.

Atropine has been generally regarded as optically active to a small extent, though Ladenburg (Ber. **21**, 3069) and Bender (Chem. Zeit. **14**, [49]) have obtained inactive preparations. The author prepared from the root of *scopolia atropoïdes*, atropine hydrobromide, which was completely inactive after two recrystallisations from hot absolute alcohol. The alkaloid, its hydrochloride and oxalate, obtained from this preparation were equally inactive. The alkaloid melted in Roth's apparatus at 115·5—116° C., and the gold salt at 136° C. Gadamer has stated that the activity of atropine is due to the presence of hyoscyamine (Arch. Pharm. **234**, 543), without, however, advancing proofs of the presence of this alkaloid. The author has examined commercial preparations of atropine. Merck's atropine hydrobromide was not altered in optical activity by recrystallisation; after conversion into the hydrochloride and fractionation of the gold double salt, pure hyoscyamine gold salt was obtained. The atropine obtained from the last fractions was still active. In a specimen of atropine sulphate, "Ph. G. III.," of low optical activity, hyoscyamine could not be detected with certainty. The author concludes that pure atropine is optically inactive; that commercial atropine, if at first feebly active, loses its activity on keeping; that the activity of commercial atropine sulphate is not altered by keeping; that the atropine in atropine gold salt containing hyoscyamine is more or less converted into hyoscyamine on keeping.

Hyoscyamine sulphate does not lose optical activity on keeping, but the free alkaloid appears to do so to a small extent. The optical rotation of the pure sulphate ($p = 4$, $t = 15^\circ$) is $-28{\cdot}2^\circ$, hence the proportions of this salt contained in the specimens of atropine sulphate "Ph. G. III." examined, are calculated to be 3·8 and 38·3 per cent.

Hyoscine is found, together with small quantities of atropine, in henbane and in *datura alba*, together with large amounts of hyoscyamine, some atropine, and atroscine, in the roots of *scopolia atropoïdes*. This alkaloid is amorphous. The crystalline scopolamine of Schmidt (Arch. Pharm. **230**, 689), which is practically the only constituent of commercial hyoscine, cannot be hyoscine.

Atroscine is extracted from the roots of *scopolia atropoïdes* by the following process. The powdered roots are extracted by ether under a reflux condenser after moistening with potassium carbonate, the extract is shaken with dilute hydrochloric acid, the acid solution made alkaline by potassium carbonate and extracted by chloroform. The residue, after removal of chloroform, is recrystallised from ether. Hyoscyamine crystallises out, hyoscine and atroscine remaining in the mother-liquor. This is neutralised by hydrobromic acid, treated with animal charcoal, evaporated at a low temperature, and set to crystallise at 0° C. The crystals are washed with alcohol, and recrystallised from water at a low temperature until hyoscyamine can no longer be detected. The alkaloids are separated from the purified hydrobromide and recrystallised from water at 0° C. Hyoscine remains in the mother-liquor. Atroscine forms two hydrates $C_{17}H_{21}NO_4 + H_2O$ and $C_{17}H_{21}NO_4 + 2H_2O$. The anhydrous alkaloid is obtained in the crystalline form by heating the monohydrate at 54°—55° C., the melting point rising to 82°—83° C. The hydrobromide, $C_{17}H_{21}NO_4.HBr + 3H_2O$, crystallises from water at 0° C. in long colourless needles. Rhombic crystals were also obtained identical with those of Ladenburg's hyoscine hydrobromide (Ber. **14**, 1871). Atroscine is decomposed by hot dilute potash into oscine and atropic acid.

—A. C. W.

Digitaleïn. H. Kiliani and A. Windaus. Arch. der Pharm. **237**, 458—466; Chem. Centr. 1899, **2**, [14], 668.

One of the authors has already stated (Arch. der Pharm. **233**, 299) that the digitaleïn of Schmiedeberg is a mixture which still contains digitalin. In the present communication it is shown that there exists both in the seeds and in the leaves of digitalis a poisonous compound easily soluble in water and free from digitalin.

1 kilo. of *digitalin pur. Germanic.* obtained from the seeds, was submitted to the treatment described in the earlier paper (*loc. cit.*) for the separation by alcohol of the digitonin and fatty substances, and by water, of the greater quantity of the digitalin. The filtrate from the precipitate of digitalin served as raw material for the preparation of the digitaleïn, and was dialysed. The dialysed liquids left behind, on evaporation *in vacuo*, 40 grms. of a light red, hygroscopic substance

which was further purified by dissolving in water, shaking with ether (for the removal of resin), and then precipitating with a 10 per cent. solution of tannic acid. The tannate was decomposed with zinc oxide, extracted with methyl alcohol, and the alcoholic extract evaporated, 15 grms. of glucoside being obtained. This glucoside still contains traces of digitalin, from which it is freed by solution in water containing some ether dissolved in it. In such liquid digitalin is but very slightly soluble. The filtered solution was then again evaporated *in vacuo*, the residue dissolved in alcohol, and twice fractionally precipitated with ether, whereby the last traces of impurities were removed. The digitalein obtained in this manner, (yield only 4—5 grms.), formed a white powder very slightly soluble in chloroform, ether, benzene, and acetone, easily soluble in water and alcohol. Digitalein is probably a lactone, as its aqueous solutions soon become acid. It is stated that Merck's digitalein still contains appreciable quantities of digitalin.

The authors found that considerable quantities of a poisonous compound (digitalein), soluble in water, could be obtained from digitalis leaves by either alcoholic or aqueous extraction.—A. S.

Liquid Alkaloid contained in Pomegranate Root Bark. A. Piccinini. Atti R. Accad. dei Lincei Roma, **8**, [5], 176—180; Chem. Centr. 1899, **2**, [19], 879.

In the preparation of methylgranatonine (pseudopelletierine), there remains behind, on crystallising out from petroleum spirit, an oily mass, from which the author obtained a liquid alkaloid of the composition $C_9H_{17}ON$. This alkaloid is distinguished from Tanret's methylpelletierine (Comptes Rend. **90**, 694), by its miscibility with water. It is a tertiary alkaloid with ketone character, and may perhaps be considered as a homologue of Liebermann and Cybulski's hygrine (Ber. **28**, 578).

The mother liquor from the methylgranatonine was distilled at 28 mm. pressure, and the fraction of 100°—120° C. collected. From this fraction the liquid alkaloid was prepared by means of its picrate. It formed a colourless oil boiling at 114—117° C., under 26 mm. pressure. The gold salt has the composition $C_9H_{17}ON.HAuCl_4$.

The aqueous solution of the base gives a sulphur-yellow precipitate with phosphomolybdic acid and a white precipitate with tannin. The hydrochloric acid solution of the base gives yellow precipitates with the double iodides of potassium and mercury, potassium and cadmium, and potassium and bismuth. The semicarbazone of the base $C_{10}H_{20}ON_4$, gives colourless crystals from boiling water, m. pt. 169° C., soluble in boiling water and alcohol, insoluble in ether. In hydrochloric acid solution, the semicarbazone gives an oily precipitate with gold chloride.

With hydroxylamine, the alkaloid gives an oily product, which has an energetic reducing action on Fehling's solution.—A. S.

Pilocarpus Racemosus (A new Source of Pilocarpine). Rocher. Repertoire de Pharmacie, 1899, 3rd ser. 11, (10), 439—440.

The author describes a new jaborandi *Pilocarpus racemosus*, indigenous in the French Antilles. The leaves contain about 1 per cent. of total alkaloids, of which 0·6 per cent. is pilocarpine and 0·4 per cent. jaborine. The leaves also contain a greenish, very aromatic essential oil.—J. O. B.

Camphor Production in Florida. Chem. and Druggist, **55**, [1035], Nov. 25, 857.

An American writer states that the growing of camphor trees in groves is now becoming a good business in Florida. Thousands of trees are being planted every year. The present process of cutting off part of the top of the trees at a time, and distilling the leaves and twigs, does not in the least injure the tree. When the trees are three years old the grower takes off about one third of the leaves and twigs. These trees will produce about 1 lb. of camphor per year, and when 15 or 20 years old will produce 3 to 4 lb. The usual custom is to plant about 300 trees per acre, and as land is cheap and trees are worth about 35 dols. per 1,000 (one year old), it costs but little to make a paying camphor-plantation. The cost of labour cuts but a small figure, and when the question of manufacture and duty of custom-house is added to the imported article, it can readily be seen that camphor can be made to pay in Florida.

Solanthic Acid. W. Bräutigam. Pharm. Zeit. **44**, 638; Chem. Centr. 1899, **2**, [14], 669.

The juice expressed from cut flowers and stems of the sunflower (*Helianthus annuus*) gave, on acidifying with hydrochloric acid and extracting with ether, a crystalline mass, which on dissolving in water and evaporating, yielded crystals of an acid $C_7H_{11}O_{10}$, named by the author solanthic acid, melting at 144° C., and soluble in alcohol, ether, and water. The acid, which is probably present in the plant as the calcium salt, sublimes without decomposition, and gives crystalline salts.—A. S.

Damascenine: A Constituent of the Seeds of Nigella Damascena L. H. Pommerehne. Arch. der Pharm. **237**, 475—480; Chem. Centr. 1899, **2**, [14], 669.

The author has made an examination of damascenine discovered by Schneider (Pharm. Centr. H. **31**, 173, 191) in the seeds of *Nigella Dam.* The base was prepared by extracting the uncrushed seeds three times with dilute hydrochloric acid, and, after making the solution alkaline, shaking with petroleum spirit. The petroleum spirit extract, which had a magnificent blue fluorescence was shaken with dilute hydrochloric acid, and the acid solution evaporated at a gentle heat. On cooling the concentrated solution, the hydrochloride of the base crystallised out in needles (yield 110 grms. from 18 kilos. of seeds), which could be obtained almost pure white in colour, by again dissolving in dilute hydrochloric acid, and decolorising with animal charcoal at 80° C. Damascenine platinum chloride $(C_{10}H_{15}NO_3.HCl)_2.PtCl_4$, forms crystals melting at 194°—198° C. The gold salt is easily decomposed. From a determination of the methoxy-groups in the platinum compounds, the author gives damascenine the following provisional formula, $C_8H_9(OCH_3)_2NO$.—A. S.

Rhubarb, and Allied Substances; The Constituents of. O. Hesse. Annalen, **309**, [1 and 2], 32—75.

Chinese Rhubarb is chiefly derived from ***Rheum Officinale Baill.***, which grows both wild and cultivated in south-east Thibet and in the west and north-west of China. Geiger (Annalen, **9**, 91, 304) separated from the drug rhababerin, an impure substance from which Schlossberger and Döpping, Warren de la Rue and Miller, Liebermann and O. Fischer isolated chrysophan or chrysophanic acid. According to Kubly, this compound does not exist ready formed in this species of rhubarb, but is produced by the decomposition of chrysophan into glucose and chrysophanic acid. Chrysophan is stated to be insoluble in ether but soluble in water; the author was unable to obtain chrysophanic acid by treatment with dilute sulphuric acid after extraction with ether, and unable to find chrysophan in this species of rhubarb.

Austrian Rhubarb is the root of ***Rheum Rhaponticum, Linn***, the plant is cultivated in several districts in Austria. The rhaponticin found in this species by Hornemann (Jahrb. Pharm., 1822, 262) was stated by Weppen to be a mixture of resins with chrysophanic acid.

English Rhubarb is the root of ***Rheum palmatum.*** From this species the same substances were extracted as from Austrian rhubarb, chrysophanic acid and rhapontin.

The presence of rhapontin in English rhubarb and its absence from the Chinese drug indicates that the latter cannot be obtained from a variety of ***Rheum palmatum*** as Tschirch and Osterle have stated. Tschirch has supposed that the purgative action of rhubarb is due to oxymethylanthraquinone derivatives; but chrysophanic acid is nearly related to this quinone, and has not the action of rhubarb upon the digestive tract. This property of rhubarb may be due to emodine or to resins. Chrysophanic acid is probably dihydroxymethylanthraquinone [$CH_3 : OH : OH = 2' : 2 : 5$]
—A. C. W.

alicylanilide-acetic Acids and their Derivatives. G. Cohn. J. prakt. Chem. 1899, **60,** [18, 19, 20], 404—406.

ALICYLANILIDE and phenetidide have, in contradistinction most other acid anilides, very little antipyretic action. hey are decomposed with great difficulty and quite isoluble in water. By heating on the water bath with loracetic acid and caustic soda, they were converted into luble acetic acid derivatives. According to the older esearches, antipyretics containing the carboxyl group ere of little value, but more recently compounds of licylacetic and citric acids with phenetidine have been uch used.

Salicylanilide acetic acid, $C_6H_5.NH.CO.C_6H_4.OCH_2.CO_2H$, elts at 157°—158° C. Its calcium salt is insoluble. alicylphenetidide acetic acid—

$$C_2H_5O.C_6H_4.NH.CO.C_6H_4.OCH_2.CO_2H,$$

elts at 175°—178°, is very stable, being undecomposed by 0 hours' boiling with caustic potash, and forms a very oluble sodium salt. The report on the pharmacological ction of these compounds, was that "they showed no dvantage over preparations already in use." Salicylanisilide acetic acid, $CH_3O.C_6H_4.NH.CO.C_6H_4.OCH_2.CO_2H$, rystallises from methyl alcohol in bundles of long needles, nelting about 174° C.—A. C. W.

Methyl Salicylate, Occurrence of, in ***Plants.*** Schimmel's Semi-Annual Report. Leipsic. Oct. 1899, 56.

In addition to the plants already recorded as yielding nethyl salicylate, the following are included:—*Viola tricolor*, *Acacia intsia*, *A. pluri-capitata*, *A. sarmentosa*, ***A. tenerrima, and A. farnesiana.***—J. O. B.

Jasmine Flowers, Essential Oil of.—III. A. Hesse. Ber. 1899, **32,** [14], 2611. See also this Journal, 1899, 513, 396, 296.

THIS essential oil contains about 2½ per cent of indole, its presence is a very important factor in the production of the specific jasmine odour. If indole be purified in the most careful manner (more than analytical purity is required, as often with perfumes), and then mixed in the proper proportion with other perfumes, it gives to the mixture a certain odour of fresh flowers. The detection and estimation of indole are easy. Mix the crude essential oil with 10 per cent. of picric acid and heat to 50°—60° C. To the cooled solution, which contains indole picrate, add a large excess of petroleum ether, filter, wash repeatedly with petroleum ether, warm with soda or ammonia, extract with ether, evaporate the solvent, and steam distil. The 800 grms. of essential oil, the distillation of which was described in the last paper, had been previously freed from indol in this manner. Attempts to isolate an aldehyde from the essential oil by means of a sodium bisulphite compound, sometimes gave a very small, sometimes no yield. It was then found that indole unites with sodium bisulphite. The compound may be obtained by shaking a solution of 2 grms. of indole in 2 grms. of ether with 8 grms. of bisulphite of 40° B., 2 grms. of water and 10 grms. of 90 per cent. alcohol. The crystalline product may be recrystallised from methyl alcohol (compare this Journal, 1899, 169). Indole is also contained in the essential oil of orange blossoms.

The jasmine essential oil contains small quantities (about 0·5 per cent.) of methyl anthranilate (see also this Journal, 1899, 604). Its presence may be detected in essential oils in which it occurs in quantities of 1—2 per cent., by adding $\frac{1}{2}$ c.c. of the oil to 1 c.c. of a mixture of 1 volume of strong sulphuric acid with 5—6 volumes of ether. The separated sulphate of the ester is quickly filtered off, washed with alcohol and ether, and the ester liberated by soda.

Preliminary experiments showed that the higher boiling portion of jasmine oil contained a ketone. To isolate this, the portion of the 800 grms. of oil (this Journal, 1899, 513) boiling *in vacuô* above 100° C. (about 60 grms.), was boiled in alcoholic solution with hydroxylamine hydrochloride and caustic potash. The oxime was separated from the product by dissolving in dilute sulphuric acid, extracting impurities with ether, and neutralising by ammonia. The oxime, when decomposed by dilute sulphuric acid, yields the ketone $C_{11}H_{16}O$, jasmone. This boils at 257°—258° C. under 755 mm. pressure, has the specific gravity 0·945 at 15° C., and possesses an extremely intense and clinging jasmine odour. The oxime crystallises from dilute alcohol in fine needles melting at 45° C.; it is volatile in steam. The semicarbazone melts at 204°—206° C. after one recrystallisation from boiling alcohol; it is readily obtained. Impurities may be removed by steam distillation, then, after adding the theoretical amount of sulphuric acid, steam distillation gives the pure ketone.

According to the author's researches, the essential oil of jasmine flowers is composed of 3 per cent. of jasmone, 2·5 per cent. of indole, 0·5 per cent. of methyl anthranilate, 65 per cent. of benzyl acetate, 7·5 per cent. of linalyl acetate, 6·0 per cent. of benzyl alcohol, and 15·5 per cent. of linalool.—A. C. W.

Ionone Process and in the "Violet Oil" Process, The Action of Bleaching Powder in the. J. Ziegler. Chem. Zeit. 1899, **23,** [89], 956—957.

IN order to ascertain whether chloride of lime might be substituted for the baryta water of Ger. Pat. 73,089 (Eng. Pat. 8736, 1893, this Journal, 1897, 1038), the following experiments were undertaken:—200 grms. of citral and 200 grms. of acetone were shaken with 3·6 litres of a saturated, filtered solution of bleaching powder for several days; 200 grms. of acetone and 150 grms. of citral were boiled with 300 c.c. of bleaching powder solution; 600 grms. of acetone and 300 grms. of citral were mixed with 600 c.c. of bleaching powder solution, and after standing 5 minutes the mixture was boiled 6 hours. In each case the resulting aqueous solution was strongly alkaline, but no trace of pseudoionone was produced. In the "Violet oil" process (Eng. Pat. 26,350, 1896, this Journal, 1897, 1038), the yield is most favourable when the aqueous layer is neutral. The alcohol and cobalt nitrate are essential to the process, which yields, not ionone, but isoionone and other higher boiling isomers of the empirical constitution $C_{13}H_{20}O$ (see also this Journal, 1898, 793, 867, 1069).—A. C. W.

Lilienfeld's Peptone Synthesis. M. Klimmer. J. Prakt. Chem. 1899, **60,** [18, 19, 20], 280—285.

LILIENFELD has claimed to obtain by the condensation of phenol with amido-acetic acid and of phenol with *p*-amidobenzoic acid and asparagin, compounds which "with complete certainty" are to be regarded as peptone or peptone hydrochloride (see this Journal, 1899, 945). The author considers it *a priori*, extremely improbable that peptone should result from the condensation of phenol and amido-acetic acid, since it has never been decomposed into these substances even in approximate proportions as to quantity. He finds, in opposition to the statement of Lilienfeld, that the product does not give the biuret reaction and further that it is readily decomposed into its constituents by sulphuric and hydrochloric acids. *Peptonum purissimum siccum* (Grübler) and glutinpeptone when similarly treated with hydrochloric acid gave neither phenol nor glycocoll.

The author concludes that, on account of its failure to give the biuret reaction and its easy decomposition into its components, Lilienfeld's so-called synthetic peptone is not a peptone.—A. C. W.

Aconite Alkaloids, Contributions to our Knowledge of the. Part XV.: Japaconitine and the Alkaloids of Japanese Aconite. W. R. Dunstan and H. M. Read. Proc. Chem. Soc. **15,** [214], 206—208.

THE authors have investigated the properties of the alkaloids of Japanese aconite, ***A. Fischeri*** ("kuza uzu"), including those of japaconitine, the crystalline alkaloid examined by Wright and Luff in 1879, who assigned to it the formula $C_{66}H_{88}N_2O_{21}$. Later workers, Mandelin, Lubbe and, more recently, Freund and Beck, have asserted that japaconitine is identical with aconitine, the crystalline toxic alkaloid of *Aconitum Napellus*.

The results obtained in the present investigation do not confirm these statements, but lead to the conclusion that japaconitine is a distinct alkaloid, the composition and properties of which, however, do not agree with those ascribed to it by Wright and Luff.

Japaconitine crystallises in colourless needles which melt at 204·5 (corr.). The crystallographic characters differ from those of aconitine. The base is soluble in acetone, alcohol, chloroform, and in ether, but almost insoluble in water and light petroleum. Its physiological action closely resembles that of aconitine. It contains four methoxyl groups, one acetyl group, and one benzoyl group. Its composition is provisionally represented by the formula $C_{21}H_{29}(OCH_3)_4(CH_3CO)(C_6H_5CO)NO_3$, which seems to agree best with the analytical data for the base and its derivatives. Japaconitine furnishes a series of well crystallised salts, of which the *hydrochloride* (m. pt. 149°—150°), the ***hydrobromide*** (m. pt. 172°—173°), the ***hydriodide*** (m. pt. 207°—208°), the ***aurichloride*** (m. pt. 231°), and the *nitrate* (m. pt. 194) are described. Like aconitine, japaconitine is dextro-rotatory, the salts being lævo-rotatory. The specific rotation of japaconitine is, however, much greater than that of aconitine.

When partially hydrolysed by dilute acids, japaconitine furnishes acetic acid, and a new crystalline base, ***japbenzaconine,*** in accordance with the equation $C_{34}H_{49}NO_{11} + H_2O = C_{32}H_{47}NO_{10} + C_2H_4O_2$. It crystallises in rectangular plates which melt at 182—183°. Its lævorotation is nearly twice that of benzaconine. The salts crystallise with extreme readiness. The ***hydrochloride*** (m. pt. 253°), the ***hydrobromide*** (m. pt. 205°), are described.

Japbenzaconine is hydrolysed on treatment with acids or alkalis, yielding benzoic acid and a base, *japaconine*, in accordance with the equation $C_{32}H_{47}NO_{10} + H_2O = C_{25}H_{43}NO_9 + C_7H_6O_2$. Japaconine has been obtained only in an amorphous condition, even the salts crystallise with great difficulty. The ***hydrobromide*** melts at 221°.

When japaconitine melts, it gradually suffers decomposition into acetic acid, and a new crystalline base, ***pyrojapaconitine,*** $C_{32}H_{45}NO_9$. The crystalline ***hydrochloride*** (m. pt. 175°—176°), ***hydrobromide*** (m. p. 208°, or in another form at 241°), are described. Both pyrojapaconitine and its salts are strongly lævo-rotatory.

Pyrojapaconitine is readily hydrolysed by alkalis or acids, yielding *benzoic acid* and *pyrojapaconine* $C_{25}H_{41}O_8$. Neither the base nor its salts have been crystallised.

Japaconitine yields a ***triacetyl*** derivative; and also a *monomethyl* derivative by decomposition of the *methiodide* with potash.

It is evident that the properties of japaconitine and its derivatives are distinct from those of aconitine and its derivatives, although there is a strong general resemblance between the two groups.

Besides the crystalline japaconitine, Japanese aconite roots were found to contain a small proportion of its first hydrolytic product, japbenzaconine.

Aconitine from ***A. Napellus,*** pseudaconitine from ***A. ferox,*** and japaconitine from Japanese aconite (probably ***A. Fischeri***) exert a very similar physiological action. The relationship between the chemical constitution and the physiological action of these alkaloids and their derivatives was being investigated by Cash and himself. They had already published (***Phil. Trans.*** 1898, **190,** B. 239) an account of the work as far as it related to aconitine, benzaconine, and aconine, and had paid special attention to the almost entire loss of toxic power which results from the elimination of the acetyl group from aconitine. In fact, benzaconine and aconine, especially the latter, were found to be, in certain respects, physiologically antagonistic to aconitine.

Phosphorised Oils, Medicinal, Determination of. E. Louise. J. Pharm. Chim. **10,** [6], 241.

See under XXIII., ***page*** 1160.

Thapsia Resin, Valuation of. K. Dieterich. Pharm. Centralb. 1899, **40,** 257.

See under XXIII., ***page*** 1159.

Lemon Oil, Valuation of. J. Walther. Pharm. Centralb. 1899, **40,** [41], 621.

See under XXIII., ***page*** 1161.

Lemon, Bergamot and Orange, Analysis of the Volati Oils of the. A. Soldaini and E. Berté. Chem. Zeit. Rep 1899, [33], 323. From Boll. Chim. farmac 1899, **38** 537.

See under XXIII., ***page*** 1160.

Citronella Oil, Determination of Geraniol and Citronella in. Schimmel's Semi-Annual Report, Oct. 1899, 24.

See under XXIII., ***page*** 1160.

PATENTS.

Acetylsalicylic Acid, Production of. H. E. Newton, London. From Farbenfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 27,088, Dec. 22, 1898.

Kraut (Annalen, **150,** 11) described the preparation of acetylsalicylic acid by the action of acetyl chloride upon salicylic acid; the compound solidified at 118° C., was not decomposed by boiling water, and gave the salicylic acid reaction with ferric chloride. The patentee claims the manufacture of true acetylsalicylic acid by heating together salicylic acid and acetic anhydride or acetyl chloride; the product solidifies at about 70° C., is decomposed by boiling with water, and does not give the violet coloration with ferric chloride.—A. C. W.

Cream of Tartar, Manufacture of. A. Martignier, Cette, France. Eng. Pat. 27,328, Dec. 27, 1898.

The object of the invention is to obtain potassium acid tartrate practically free from the calcium salt.

Hydrochloric or sulphuric acid, in slight excess of the calcium bitartrate present, is used in the first refining operation to obtain red crystals, which are then stated to contain 96 to 97 per cent. of potassium bitartrate, a proportion increased to 99 per cent. by a second refining, with a new addition of the acid. The bone-black used to decolorise the product should have a preliminary washing with one of the stated acids. The tartaric acid remaining in the mother liquor is transformed into a calcium salt for recovery.
—E. S.

Bromide of Albumen, Bromide of Peptone and Albuminous or Peptonous Derivatives of Bromine, Production of. S. S. Bromhead, London. From Chemische Fabrik Helfenberg Actien Gesellschaft, Helfenberg, Dresden, Germany. Eng. Pat. 17,934, Sept. 5, 1899.

The process consists in mixing a solution of bromine in dilute alcohol with an aqueous solution of albumin or peptone, allowing to stand, concentrating, washing with alcohol and drying.

The albumin bromide which contains 12 per cent. of bromine, is proposed as a sedative.—A. C. W.

Alkylised-uric Acid, Preparation of. G. W. Johnson, London. From C. F. Boehringer and Soehne, Waldhof, Mannheim, Germany. Eng. Pat. 19,413, Sept. 27, 1899.

The processes claimed by Eng. Pats. 20,447, 1898, and 1678, 1899 (this Journal, 1899, 172, 856), may be combined. The patentee now claims the process for the manufacture of alkylised uric acids, which consists in adding tin to a solution containing hydrochloric acid, uric acid, and formaldehyde.—A. C. W.

XXI.—PHOTOGRAPHY.

Hydroquinone, Developing with. C. Fery. Bull. Soc. Franç. de Photogr. **15,** [13], 313—315; Mois Scient. et Indust. 1899, [4], 203.

The principal advantage of the method consists in the image being produced by metallic silver exclusively, thus facilitating subsequent modifications on the print.

The print, carefully freed from traces of fixing solution, is immersed in cupric bromide solution ($CuSO_4$ 25 grms., KBr 25 grms. per litre), which is thereby reduced to the cuprous state, the silver in the print being converted into bromide. A succeeding bath of 2 per cent. silver nitrate transforms the cuprous salt into the soluble nitrate and gives a further deposit of silver bromide. After washing t the soluble salts, the print is developed in a bath of droquinone (10 grms. with 150 grms. sodium carbonate, d 75 grms. sodium sulphite in 1 litre of water). When e liquid draining from the plate is no longer tinged with ange, the print is washed and dried. The reduction is ore rapid in a good light. If sufficient opacity is not tained the first time, the operation is repeated before ying.—C. S.

ntensification of Photographic Negatives by Means of Mercuric Iodide. Lumière Bros. and Seyewetz. Monit. Scient. 1899, **13**, [11], 782.

HE use of mercuric iodide dissolved in sodium thiosulhate as a photographic intensifier was first recommended y Edwards. Mercuric iodide is preferable to the more ommonly employed chloride, because in the former case e process is direct, and the gain in density can be watched, r the rapidity of intensification controlled by diluting the olution; whereas with the chloride a subsequent treatment ith ammonia, &c., is necessary, so that the final effect on he negative cannot be judged until the whole (double) peration is finished.

Intensified with mercuric iodide, however, negatives lack tability; they gradually turn yellow, and slowly lose ensity when exposed to the air; while a similar degradaion occurs rapidly when they are soaked even in distilled water. As prepared by the usual formulæ, the intensifying liquid contains presumably a double salt of the composition $HgI_2 + 2Na_2S_2O_3$; in contact with metallic silver, the mercuric iodide is reduced to mercurous iodide, which reacts with the thiosulphate yielding metallic mercury. The whole process, accordingly, may be represented as follows:—

$$Ag_2 + 2HgI_2 + 2Na_2S_2O_3 = Hg + 2AgI + [HgI_2,(Na_2S_2O_3)_2].$$

The intensified image should thus contain free silver iodide: an hypothesis which is borne out by the fact that it is "reduced" (in photographic language) partially or to its original degree of density by treatment with a solution of thiosulphate; the colour of the image becoming browner.

To ascertain the nature of the change that accompanies the yellowing of the negative on exposure, various experiments were tried. It was found that the yellow substance (1) was not darkened by the action of such bodies (sodium sulphite, potassium iodide) as convert mercurous iodide into mercuric iodide and mercury; (2) that it was dissolved and not darkened by thiosulphate; (3) that other solvents of mercuric iodide had no action upon it; (4) that weak nitric or hydrochloric acid bleached it slowly; (5) that dilute ammonia produced no change; (6) that it was decomposed by bodies which are "developers" of silver iodide, the image darkening without sensible alteration in density. It may, therefore, be supposed that the mercury in the intensified negative is oxidised in damp air, or by the oxygen dissolved in water, till it yields a yellow compound, HgO,AgI; evidently, the silver iodide has not reacted with the mercury to form mercurous iodide, as was at first imagined. If the intensified picture is placed, after a short wash, in an ordinary developer, the silver iodide is reduced, the steady deterioration of the image is prevented, the photographic density of the negative is not affected, and only by examination with reflected light is the slight opalescence due to the presence of the iodide seen to have disappeared.

The authors have observed that mercuric iodide is very soluble in a solution of sodium sulphite, and that such a liquid is a powerful intensifier. According to the above theory of the thiosulphate process, it follows that the solvent must be kept within the prescribed limits, especially avoiding excess. Sodium sulphite, on the contrary, can be used in any proportion, as it does not attack the intensified image. A standard formula for its employment is: mercuric iodide, 1 part; anhydrous sodium sulphite, 10 parts; water, 100 parts. The liquid can be diluted, or the proportion of iodide diminished, when a slower action is desired; or the quantity of water may be halved to gain greater rapidity. In all probability, the mechanism of the reactions is precisely analogous to that given already: the negative is liable to become yellow in air and water; but this can be absolutely prevented by "developing" the intensified plate. Without development, its permanence can be increased somewhat by immersing it in a 10 per cent. solution of sodium sulphite, and then washing thoroughly.

Experiments were tried with various other solvents of mercuric iodide: potassium iodide and chloride, sodium chloride, ammonium chloride. The chlorides of potassium and sodium do not dissolve much of the mercuric iodide; the others exhibit a defect of yielding an orange precipitate, perhaps a mixture of mercurous and mercuric iodide, within the film when the negative is washed after intensification. It is not practicable to avoid this by increasing the proportion of solvent; for if the intensifying bath contain more than about 6 per cent. of an alkali metal chloride or iodide, the gelatin is attacked.

The authors, therefore, maintain that sodium sulphite is the best of all solvents for mercuric iodide; and although the negatives, so intensified, are rendered fairly stable by simple treatment in a second bath of sulphite only, it is indispensable to "develop" the intensified picture whenever complete permanence in air and moisture is requisite.

—F. H. L.

PATENTS.

Photography, Orthochromatic; Means for Use in. R. W. Artlett, Richmond. Eng. Pat. 27,373, Dec. 28, 1898.

Two glass discs are coated, one with a yellow film having a small circular vacant space in the centre, the other with a red film with a larger space in a similar position. The discs so prepared are cemented together, film to film, and placed in a position close to the diaphragm. Such a screen so transmits light that the various shades of colour are represented by appropriate half-tones.—G. W. McD.

Photographic Films. J. Meyer, New York. Eng. Pat. 17,098, Aug. 23, 1899.

FRESHLY precipitated silver phosphate is mixed with a solution of tartaric acid or citric acid, and the emulsion so formed is used for coating the surface to be sensitised without the aid of any viscous substance.—G. W. McD.

XXII.—EXPLOSIVES, MATCHES, Etc.

PATENTS.

Safety Fuse, Manufacture of Suitable, for Blasting and Mining Purposes. W. F. Reid, Surrey, and E. J. V. Earle, London. Eng. Pat. 26,893, Dec. 20, 1898.

THE safety-fuse is waterproofed by coating it with a solution prepared as follows:—Castor oil or linseed oil is nitrated with nitric acid. After purification, two parts of the nitrated oil are mixed with one part of nitrocellulose with a low percentage of nitrogen, and one part of this mixture is dissolved in four parts of acetone. When the fuse has been coated with this solution, the solvent is evaporated by heating, and leaves behind it a waterproof covering.

—G. W. McD.

Explosives. L. Davies, Kyles of Bute. Eng. Pat. 27,316, Dec. 27, 1898.

A FLAMELESS blasting explosive, composed of 80—90 per cent. of ammonium nitrate, 10—20 per cent. of lignite, with or without 1 per cent. of paraffin wax. An explosive suitable for military and sporting purposes can be produced by adding one-third of ordinary gunpowder.—G. W. McD.

Explosive, An Improved. T. H. Kelly, G. W. Bell, and R. N. Kirk, all of Sydney. Eng. Pat. 8680, April 25, 1899.

EUCALYPTUS leaves are nitrated from 15 to 30 minutes in a mixed acid containing two parts of sulphuric acid to one of nitric acid, and the nitrated product, after washing and drying, is rubbed through sieves to a powder, and, either in this form or in the compressed state, is used as an explosive. (See also this Journal, 1899, 858—859.)

—G. W. McD

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Platinum Crucibles, Cleansing of. F. Wirthle. Chem. Zeit. 1899, **23**, [77], 803.

In cases where the crucible has been used for the ignition of the ash of roots, the author recommends fusing the insoluble contents with borax instead of with potassium bisulphate.—C. A. M

Platinum Wires Sealed into Glass, Protection for. W. Palmaer. Ber. **32**, [14], 2570—2571.

The end of the platinum wire projecting outside of the endiometer or other apparatus is surrounded by a short narrow glass tube which is melted on to the glass vessel. This narrow tube is filled with mercury, into which dips the connecting wire. By appropriately bending the little glass tube, the connexion can be made available for platinum wires projecting horizontally or downward from the apparatus; and by constricting the opening at the free end of the tube the risk of spilling the mercury by accidental shaking of the apparatus can be very greatly lessened.—J. T. D

INORGANIC CHEMISTRY.—QUANTITATIVE.

Nitrogen Dioxide, Determination of. G. von. Knorre and K. Arndt. Ber. **32**, [13], 2136—2141.

When nitrogen dioxide and hydrogen are passed over heated palladium, both free nitrogen and ammonia are formed, in proportions varying with the circumstances of the experiment; but when the gases are passed over platinum heated to bright redness in a Drehschmidt's tube, nitrogen alone is formed, and the volume of nitrogen dioxide can be calculated from the contraction in volume ($2NO + 2H_2 = 2H_2O + N_2$), every two volumes of nitrogen dioxide giving a contraction of three volumes. To avoid the formation of ammonia, the temperature of the platinum tube must be kept sufficiently high, and the gases must be passed very slowly.

With nitrogen monoxide, under similar circumstances, the contraction in volume is equal to the volume of the nitrogen monoxide; hence the composition of a mixture of the monoxide and the dioxide can be calculated from the contraction which takes place when the mixture is passed through the hot platinum-tube. Measurement of the nitrogen produced or of the hydrogen used affords a check on the accuracy of the result. By measuring both the contraction and the nitrogen present after the combustion, the method affords a means of determining the composition of a mixture of nitrogen dioxide, nitrogen monoxide, and free nitrogen.—J. T. D.

Ammonia Waters, Estimation of Carbonic Acid in. Chevalet. Chem. Zeit. Rep. 1899, [33], 322. From Ann. Chim. anal. appliq. 1899, **4**, 295.

The estimation of carbonic acid in ammonia waters containing sulphuretted hydrogen may be made by means of an ordinary carbonic acid apparatus. The large compartment of the apparatus contains acid cuprous chloride solution, the part which generally contains the acid is now used for the solution under examination and the absorption portion contains pumice moistened with sulphuric acid. The operation proceeds in the usual manner.—A. C. W.

Boric Acid, Estimation of, in Tourmaline. G. W. Sargent. J. Amer. Chem. Soc. 1899, **21**, [10], 858—888.

From the results of experiments made with the object of avoiding the introduction of alkalis, it was found that when the mineral was heated with metallic magnesium and a current of chlorine subsequently passed over the heated substance to volatilise the boron, there was apparently a complete decomposition of the tourmaline, but the boron was either not completely volatilised as chloride, or, if so, was not decomposed when it came in contact with water saturated with chlorine.

A complete decomposition was effected by fusing the mineral with calcium or barium carbonate, but the separation of the boric acid was incomplete, some being still retained by the aluminium. Reliable results were obtained by fusion with an alkali carbonate, volatilising the boron from an acid solution as the methyl ester, and titrating it by Thomson's method (this Journal, 1893, 432).

It has been shown that boric acid is appreciably volatile in the presence of ammonia, but the author has found that the introduction of calcium oxide to bind the boric acid enables one to boil an ammoniacal solution without loss.

Boric acid, with the exception of negligeable quantities, can be separated from insoluble oxides by re-fusion. After twice fusing and digesting the extract with ammonium chloride under a reflux condenser, evaporating the solution to dryness in a platinum basin after the addition of lime, and igniting the residue, the silica and alumina are rendered insoluble. On now digesting with sodium carbonate, borax is formed, in which the boric acid can be titrated by Thomson's method. The author found this method to give good results with alumina containing silicates, and still better results with datolite. The time required was about four hours.

It is suggested that the difficulty often experienced in obtaining concordant results in the analysis of minerals such as tourmaline, where the hydrochloric acid solution of the fused mass is evaporated to dryness, may be due to the incomplete volatilisation of the boric acid. If so, the difficulty might be obviated by the addition of methyl alcohol during the evaporation (this Journal, 1893, 867).
—C. A. M.

Electrodes of Platinum Gauze, Electrolytic Determination of Metals with. C. Winkler. Ber. **32**, [13], 2192—2194.

With the ordinary conical or cylindrical cathode of foil, the current density (and hence the thickness and coherence of the deposit) is not uniform over the whole surface, while with a flat cathode between the limbs of a forked anode, it is difficult to prevent the deposit from peeling off. The author has worked with a cathode of platinum gauze (wire 0·12 mm. diameter, 250 meshes to the sq. cm.) 10·5 cm. by 5·5 cm. The edges are folded in to stiffen it, and a platinum conducting wire is attached to the middle of a longer edge; the electrode is then rolled into a split cylinder of 3·5 cm. diameter, and used as cathode with the ordinary spiral wire anode. The deposited metals adhere so firmly to the wire that much higher current densities are practicable than with the ordinary cathode, and a corresponding shortening of the time required for complete deposition is effected. Paweck, in Austria, has already worked with electrodes of brass wire gauze, either clean or amalgamated, for the electrolytic deposition of zinc.—J. T. D.

Manganese, Volumetric Determination of, in Salts of Manganic Acid. C. Reichard. Chem. Zeit. 1899, **23**, [77], 801—802.

The method is based on the fact that manganic acid is decomposed by alkaline solutions of arsenious acid in the cold, as, for instance, in the case of potassium permanganate—

$$4KMnO_4 + 5As_2O_3 = 5As_2O_5 + 2K_2O + 4MnO.$$

In aqueous solution the reaction takes place after heating the liquid to about 50° C.

Since arsenious acid can readily be obtained in a pure state, this reaction can be employed for the indirect volumetric estimation of manganic acid, and a gravimetric determination of the separated manganous oxide may be used as a check on the results.

In the volumetric estimation, an excess of a standard solution of arsenious acid, dissolved with the aid of caustic soda, is added to the solution of the manganic acid salt, and the mixture heated until the liquid above the manganous oxide is clear. The precipitate is then filtered off and washed with hot water, and the filtrate neutralised with hydrochloric acid, and, after the addition of sodium bicarbonate, titrated with standard iodine solution. From the difference between the amount of iodine consumed by the original arsenious acid solution and that remaining after the reaction, the amount of manganese can be calculated according to the reaction given above.

Instead of filtering off the manganous oxide, the method may be shortened by adding sulphuric acid to dissolve the precipitate and titrating the liquid with potassium permanganate solution previously standardised in sulphuric acid solution on arsenious acid.

The author describes a number of test experiments on potassium permanganate, from which it appears that the results obtained by this method agree within 0·1 mgrm. of the theoretical amount.—C. A. M.

Iron and Steel, Determination of Chromium in. E. Döhler. Chem. Zeit. 1899, **23**, 868.

Experiments made by the author show that a single digestion with barium carbonate of the solution of the iron or steel does not remove the whole of the chromium. He dissolves 2·5 grms. (for 1—5 per cent. of chromium) or 5 grms. (for less than 1 per cent.) of the metal in 30 c.c. of hydrochloric acid of sp. gr. 1·19 and 100 c.c. of water, in a flask closed by a cork furnished with an escape valve. After solution and cooling, cold water is added to fill three-fourths of the flask, and precipitated barium carbonate added in small portions at a time, till it is present in distinct excess. The flask is then closed, allowed to stand for 12 hours, and the contents filtered, protected as well as possible from the air. The precipitate is well washed, the first washings being added to the filtrate, which is then a second time treated with barium carbonate, allowed to stand, and filtered as before. The two portions of barium carbonate, after drying, are fused in a porcelain crucible with 5 grms. of sodium carbonate and 2 grms. of nitre. The cold melt is extracted with water, filtered, the filtrate evaporated with hydrochloric acid to remove silica, and the chromium separated from the aluminium and weighed in the usual manner.—J. T. D.

White Metal, Analysis of. H. Nissenson. Chem. Zeit. 1899, **23**, [81], 868.

The following process was devised for the analysis of alloys containing about 80 per cent. of lead, 5 to 15 per cent. each of tin and antimony, and 0·5 per cent. of copper. To 1 grm. of the alloy, in an Erlenmeyer flask, add 2—4 grms. of tartaric acid, 12 c.c. of water, and 4 c.c. of strong nitric acid, and warm gently till the whole is dissolved. Add 4 c.c. of strong sulphuric acid, and heat. By means of a small right-angled glass tube blow out the nitrous fumes from time to time, and when they cease to be generated and white fumes begin to appear, stop the heating—the nitric acid is completely expelled, and the tartaric acid has not been destroyed. On cooling, add water, allow the lead sulphate to settle, filter, and weigh the lead as usual. Make the filtrate alkaline with sodium hydroxide, add 50 c.c. of saturated sodium sulphide solution, warm, filter, and wash from the deposited copper sulphide, into a platinum basin. Electrolyse, warming repeatedly to 80° C., by a current of 1·5 ampères at 3 volts; pour off, wash, and weigh the antimony. To the remaining liquid add 25 grms. of ammonium sulphate, and from the ammonium sulphide solution thus made, warmed as before, deposit the tin by the same current, at the same voltage, as used for the antimony.—J. T. D.

Iron from Chromium, Zirconium, and Beryllium, Separation of, by the Action of Hydrochloric Acid Gas upon the Oxides. F. S. Havens and A. F. Way. Amer. J. Science, Silliman, **8**, [4], 217. Chem. Centr. 1899, **2**, [16], 792.

Gooch and Havens (Amer. J. Science, Silliman, **7**, [4], 370), have pointed out that ferric oxide in a strong current of hydrochloric acid gas at 450°—500° C., can be completely volatilised as chloride, and that, by the further addition of chlorine, the process proceeds smoothly at 180°—200° C. The separation of iron and aluminium was effected by means of the reaction.

In the present paper, it is shown that the oxides of chromium, zirconium, and beryllium, are not attacked by dry hydrochloric acid gas, and they can, therefore, be completely separated from iron. A portion of one of the above-mentioned oxides was mixed with an equal weight of iron oxide, and placed in a porcelain vessel in a spacious glass tube. The tube was placed in the combustion furnace, and a current of dry hydrochloric acid gas containing chlorine passed through, the temperature being maintained at 200°—300° C. The time necessary for carrying out the process varied, but 0·1 grm. of iron could be completely volatilised in 1 hour at 200° C. It is not advisable to accelerate the reaction by heat, or mechanical losses may easily occur.

—A. S.

Nickel, Determination of, in Nickel Steel. G. W. Sargent. J. Amer. Chem. Soc. 1899, **21**, [10], 854—857.

Two grms. of the steel are dissolved in hydrochloric acid (1·1 sp. gr.), and the solution oxidised by 1 c.c. of strong nitric acid, and evaporated to dryness. The residue is taken up in 20 c.c. of hydrochloric acid, the solution evaporated to half its volume, transferred to a separating funnel, and the beaker washed out with warm hydrochloric acid. When the contents of the funnel are cold, 40 c.c. of ether, which is free from alcohol and which has previously been shaken with 5 c.c. of hydrochloric acid, are introduced, and the mixture well shaken for 10 minutes, whilst the temperature is prevented from rising, by placing the funnel under running water from time to time. Then after standing for a short time, the lower aqueous layer is drawn off, and the ether left in the funnel washed with hydrochloric acid (sp. gr. 1·1), the washings added to the aqueous solution, and the ethereal solution containing the ferric chloride run into the waste ether bottle.

The aqueous solution, which contains the chlorides of nickel, copper, manganese, and other metals is boiled to expel ether, diluted to at least 200 c.c., again boiled, and the iron and manganese present precipitated by the addition of ammonia in excess and 10 to 20 drops of bromine water. The precipitate is dissolved in hydrochloric acid, reprecipitated, and the filtrate from this precipitate added to the first filtrate. The liquid is boiled, filtered if necessary, again boiled until the excess of bromine is expelled, and the copper precipitated as sulphide.

The filtrate from the copper sulphide, which now contains only the nickel, is evaporated to 100 c.c., cooled, and ammonia added until an excess of 1 c.c. thereof has been reached. Five c.c. of a silver nitrate solution (0·5 grm. per litre) are then introduced together with the same quantity of a 2 per cent. solution of potassium iodide, and the opalescent solution titrated with standard potassium cyanide solution (1 c.c. = about 0·001 grm. of nickel) until it becomes bright and clear.

The potassium cyanide solution is standardised on a solution containing a known quantity of recrystallised nickel nitrate ($Ni(NO_3)_2, 6H_2O$), and a blank determination must be made upon the silver nitrate and potassium iodide used in the actual determination, and the amount found deducted from the results of each titration. The presence of varying quantities of ammonium chloride in the solution does not affect the results.

In estimating nickel in ferro-nickel by this method, 20 grms. of the sample are dissolved in *aqua regia*, the solution evaporated to dryness, the residue taken up with hydrochloric acid (sp. gr. 1·1), and the solution made up to a litre. Fifty c.c. of this are mixed with 5 c.c. of strong hydrochloric acid, concentrated to a sixth of its volume, and the nickel estimated by the method described above.

In the test experiments quoted, the amount of nickel found in this way agrees very closely with the theoretical quantity, or with that obtained by other methods.

—C. A. M.

Separation of Phosphates from Tellurates and Selenates, and Action of Hydrochloric Acid Gas on Sulphates, Selenates, Tellurates, and Phosphates. R. W. Tunnell and E. F. Smith. J. Amer. Chem. Soc. 1899, **21**, [10], 929.

See under VII., *page* 1123.

ORGANIC CHEMISTRY.—QUALITATIVE.

Sesamé Oil, Investigation of Bishop's Reaction for. H. Kreis. Chem. Zeit. 1899, **23,** [77], 802—803.

The blue coloration which Ambühl (Schweiz. Wochensch. Chem. 1892, **30,** 382), obtained in the Baudouin reaction with an old specimen of sesamé oil has hitherto remained unexplained. From a number of experiments on the subject, the author has come to the conclusion that it was due to a mixture of the red colour of the ordinary Baudouin reaction with the colour obtained in Bishop's reaction, according to which old sesamé oil gives a green coloration when shaken with hydrochloric acid of sp. gr. 1·19. He finds that various shades of blue can be obtained by combining the products of the two reactions. The blue coloration with old sesamé oil in the Baudouin reaction can be best produced by the use of sugar instead of furfural. The yellowish-green which appears first in Bishop's reaction gradually changes to bluish-green, whilst the oily layer eventually becomes pale violet.

Bishop considered that his test might be employed to detect rancidity and certain kinds of decomposition in fats. Since Schmid (Zeit. anal. Chem. 1898, **37,** 301) has stated that rancidity of fats is probably due to the formation of aldehydic or ketonic oxidation products of the glycerin, the author has made experiments on the assumption that these oxidation compounds give the green coloration in Bishop's reaction, and has mixed fats of varying degrees of rancidity with fresh sesamé oil, and tested the mixture with concentrated hydrochloric acid.

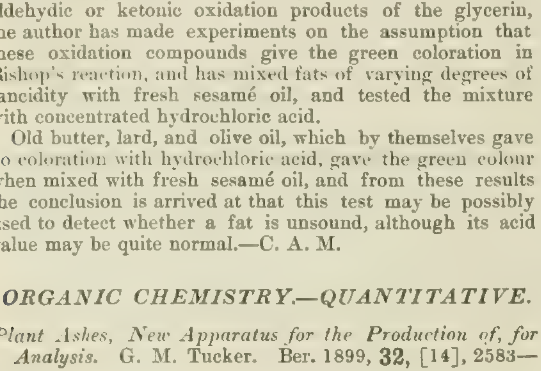
Old butter, lard, and olive oil, which by themselves gave no coloration with hydrochloric acid, gave the green colour when mixed with fresh sesamé oil, and from these results the conclusion is arrived at that this test may be possibly used to detect whether a fat is unsound, although its acid value may be quite normal.—C. A. M.

ORGANIC CHEMISTRY.—QUANTITATIVE.

Plant Ashes, New Apparatus for the Production of, for Analysis. G. M. Tucker. Ber. 1899, **32,** [14], 2583—2585.

The apparatus designed by Shuttleworth for this purpose is complicated, and gives no opportunity of ascertaining whether potash or chlorine are lost by volatilisation (Journ. für Landw. 1899, 173).

The author modifies this apparatus by aspirating the air current instead of blowing it. The figure shows (half size) a platinum crucible *a* with a well-fitting lid, which carries the tube *b*, reaching nearly to the bottom of the crucible Through this tube passes the platinum stirrer *c*. The platinum tube *f* is attached to a second opening *e*; it is joined to a small wash-bottle. A loosely-fitting cap *d* prevents the escape of particles of ash with the air current. The heating is commenced in a conical sand-bath, and continued over the open flame, the crucible being then supported by the asbestos sheet *h*.—A. C. W.



Acetylene, Preparation of Ammoniacal Cuprous Solution for Detecting, by Means of Hydroxylamine. L. Ilosvay von N. Ilosva. Ber. **32,** [14], 2697—2699.

Hydroxylamine is a very convenient substance for reducing cupric salts to the cuprous condition; but the tint of the precipitate produced by acetylene in such a solution varies greatly with the proportions of the constituents. The author prepares solutions for the detection of acetylene according to one of the three following formulæ:—(1) Cupric chloride ($CuCl_2.3H_2O$), 0·75 grm.; ammonium chloride, 1·5 grm.; ammonia (20 per cent. of NH_4), 3 c.c.; hydroxylamine hydrochloride, 2·5 grms. (2) Cupric nitrate [$Cu(NO_3)_2.5H_2O$], 1 grm.; ammonia (as above), 4 c.c.; hydroxylamine hydrochloride, 3 grms. (3) As No. 2, reading for cupric nitrate, crystallised cupric sulphate. The copper salt is dissolved in a little water in a 50-c.c. flask, the ammonia gradually dropped in, the hydroxylamine salt added; the whole well shaken and at once made up to 50 c.c. In a few minutes the solution is colourless and ready for use, and remains available for two or three days, after which its sensitiveness gradually diminishes. The acetylene in coal-gas is readily demonstrated with this solution by shaking a few c.c. with half a litre of the gas, or by leading the gas through a bulb-tube containing cotton-wool or glass-wool soaked in the reagent. The nitrate solution is the most sensitive, but the precipitate seems to be less stable than those formed in the other solutions.—J. T. D.

Phenols, Estimation of, by Bromine. W. Vaubel Zeits. für angew. Chem. 1899, [43], 1031—1032.

This paper is a reply to a recent paper by Ditz and Cedivoda (Zeits. für angew. Chem. [37 and 38]) with reference to discrepancies between the author's results and those of Stockmeier and Thurnauer, who, however, had insufficiently described their method. Beckurts and Endemann have already shown that the bromine value of the phenols can vary, but the author claims priority with regard to his work on the absorption of bromine by amido and hydroxy derivatives of benzene, showing that it depends upon the position of the other substituents as to whether bromine can be taken up and in what quantity. The author acknowledges his indebtedness in this matter to H. Reinhardt, who devised in Kalle's laboratory a method for estimating aniline and toluidine (this Journal, 1893, 954). He finds further that Ditz and Cedivoda's results fully confirm his views as to the constitution of benzene when they state that tribromphenol bromide and tribrom-*m*-cresol bromide react readily with potasssium iodide, whilst dibrom-*o*- and *p*-cresol bromide react with difficulty. In the case of the latter, the methyl group protects the OBr group. With regard to the titration method in acid solution in the case of phenols, he suggests tentatively that this might be employed in mixtures with cresols. The final result would then be that in mixtures of cresols the amounts are determinable of the *o*- and *p*-cresols on the one hand and of the *m*-cresol on the other, whilst in mixtures of phenol, *o*- and *p*-cresol, the amount of the former and the sum of the two latter can be estimated. In estimating also the quantities of naphthol and naphthylamine sulphonic acids (this Journal, 1894, 548), it is necessary to work with a considerable excess of acid. The method is frequently employed in factory laboratories, and is especially useful in cases where other methods, *e.g.*, diazo solutions, are inapplicable.—T. A. L.

Phytosterin and Cholesterin in Fats, Detection and Estimation of. H. Kreis and E. Rudin. Chem. Zeit. 1899, **23,** [92], 986.

The method described by Kreis and Wolf (this Journal, 1898, 1075) having been adversely criticised by various chemists, the authors have made further experiments on the subject, from which it appears that the yields of phytosterin and cholesterin given by it are by no means quantitative.

The following modification is said to give much more satisfactory results:—50 grms. of the fat are saponified with 125 c.c. of 95 per cent. alcohol and 25 c.c. of 40 per cent. sodium hydroxide solution, the alcohol evaporated, and the soap dissolved in 500 c.c. of boiling water and precipitated with 100 to 200 c.c. of a 10 per cent. aqueous solution of calcium chloride. When cold the liquid is filtered through a cotton cloth, and the calcium soap dried between filter paper, finely powdered, and allowed to stand in contact with 100 c.c. of a mixture of equal parts of alcohol and ether for an hour with frequent agitation. It is then washed on a filter with 50 c.c. of alcohol and ether, and the filtrate and washings, after evaporation of the ether, mixed with 3 c.c. of 40 per cent. sodium hydroxide and evaporated to dryness. The residue is mixed with about 20 grms. of quartz sand and dried on the water-bath, and subsequently for about an hour in the hot-water oven. Finally it is extracted with ether in a Soxhlet apparatus, the ethereal extract evaporated, and the residue recrystallised from alcohol.

The following results (ethereal residue) were thus obtained:—Phytosterin from cotton-seed oil, 0·1480 grm.; cholesterin from butter, 0·1754 grm.; and cholesterin and phytosterin from lard containing 5 per cent. of cotton-seed oil, 0·0768 grm.—C. A. M.

Thapsia Resin, Valuation of. K. Dieterich. Pharm. Centralh. 1899, **40**, 257—261.

This resin, which has considerable application in Continental medicine as a vesicant, is rarely met with in commerce in a state of purity. A rough, but efficient, though somewhat inconvenient method of determining the efficacy of the drug consists in the application of a small particle to the skin; the vesication produced differs from that excited by cantharides, consisting of small red, eczematous blisters, rather than one large blister. To determine the value of the resin, and at the same time to avoid the inconvenience arising from the presence of the blistering principle, the following scheme of analysis is suggested:—

(*a.*) Determination of the proportion of matter soluble in petroleum ether.
(*b.*) Saponification number of the portion soluble in petroleum spirit calculated to 1 grm.
(*c.*) Determination of the proportion soluble in alcohol.
(*d.*) Determination of the proportion insoluble in alcohol.
(*e.*) Saponification number of the proportion soluble in alcohol calculated to 1 grm.
(*f.*) Total saponification number of the resin.
(*g.*) Determination of water.
(*h.*) Determination of ash.

The details of the method are as follows:—About 1 grm. of the resin is mixed with a known weight of pure sand, the crumbly mass is filled into a tared extraction cartridge, the total weight noted, and the whole extracted in a Soxhlet tube for three hours with petroleum spirit; it is then allowed to cool and the cartridge dried at a temperature of 80° C. until no further odour of petroleum spirit is noticed (further drying is unadvisable, because of probable loss of water). The proportion soluble in petroleum spirit is ascertained by loss of weight of the contents of the cartridge. The extract is meanwhile heated with 20 c.c. of semi-normal alcoholic potash under a reflux condenser, for 30 minutes, allowed to cool, and the excess titrated back. The saponification number so obtained is calculated to 1 grm. The cartridge with contents is again introduced into the Soxhlet, the receiving flask containing 20 c.c. of semi-normal alcoholic potash and 50 c.c. of alcohol; extraction is continued for two hours, so that extraction and saponification proceed simultaneously. On cooling, the cartridge is dried to a constant weight at 100° C.; the weight lost calculated to percentage gives the proportion soluble in alcohol. The portion remaining in the flask is titrated with semi-normal acid and the saponification value calculated to 1 grm. The author adds here that the saponification number of the petroleum ether and alcohol soluble portion has been intentionally calculated to a 1-grm. portion, in order to be consistent with the definition "Saponification number" (*x* mg. of KOH for 1 grm. of substance). To determine the total saponification number, about 1 grm. of the resin is saponified with 25 c.c. of semi-normal alcoholic potash under a reflux condenser, the uncombined alkali titrated back in the usual manner, and the value corrected to 1 grm. The proportions of water and ash are determined by the usual methods, care being taken to dry in a well-ventilated bath.

The author gives the following as the limits and average figures in round numbers, of normal specimens of the drug:—

—	Limits.	Averages.
	Per Cent.	
(1) Water	7·43 to 10·336	9·0
(2) Ash	0·16 to 0·415	0·3
(3) Soluble in petroleum ether	19·28 to 25·67	22·5
(4) Saponification number of 3	251·94 to 360·18	305·0
(5) Soluble in alcohol	83·46 to 89·32	86·5
(6) Saponification number of 5	367·86 to 405·55	386·0
(7) Insoluble in alcohol	0·0 to 2·4	1·2
(8) Total saponification number.	336·0 to 384·0	360·0

The results obtained with commercial specimens show a wide divergence from these figures.—J. O. B.

Sulphur, Determination of, in Organic Substances. R. Henriques. Chem. Zeit. 1899, **23**, [81], 869.

1 grm. of the substance is gradually added to 10 c.c. of strong nitric acid, with due precautions, and heat is applied. More acid is added and the whole evaporated. Add gradually, with stirring, a powdered mixture of sodium carbonate and nitre (5 parts to 3) till the whole appears dry, cover with more of the mixture (say 5 grms. in all), and heat on the water-bath till no more carbon dioxide is evolved. Now cover the dish with a second similar one, and heat over a small flame. The whole operation of fusion will require an hour or an hour and a half. After cooling, the mass is extracted with hot water, filtered, and the sulphur precipitated as barium sulphate in the usual way.—J. T. D.

Reducing Sugars, New Method of Estimating. P. Chapelle. J. Pharm. Chim. 1899, **10**, [9], 395—398.

The Fehling's solution recommended by the author contains 35 grms. of copper sulphate, 92 grms. of tartaric acid, 115 grms. of caustic soda, and 70 grms. of caustic potash per litre. 25 c.c. of this liquid are mixed in centrifugal tubes with the sugar solution, and the total volume is brought up to 37·5 c.c., *i.e.*, 1·5 times that of the Fehling's solution. The tubes are heated in a bath of calcium chloride solution boiling at about 110° C., for six minutes in the case of glucose, and 10 minutes for lactose; they are then removed and centrifugated. After three or four minutes the precipitate adheres so strongly to the sides that the tube can be inverted and the liquor decanted without loss of oxide. The deposit in the tube is washed down with boiling water and again centrifugalised, and after decantation of the washings the tube and oxide are rapidly dried in an oven at 150°—180° C. Thus no filtration is necessary and the attendant errors are avoided. If the deposit have not a pure red colour, it is advisable to verify its purity by reduction to metallic copper.

The following equations are given for calculation of the results, where y = weight of Cu_2O and x = weight of sugar. $y = -0\cdot0025\,x^2 + 2\cdot35\,x + 3\cdot5$ for glucose. $y = -0\cdot0025\,x^2 + 2\cdot40\,x + 2\cdot5$ for invert sugar (calculated as saccharose). $y = -0\cdot0025\,x^2 + 1\cdot435\,x + 6\cdot8$ for lactose.

Reduced mercury can be separated and weighed in the same way, and a Sachsse solution containing 22·7 grms. of mercuric iodide, 40 grms. of potassium iodide, and 100 grms. of caustic potash per litre is advised.

$y = -0\cdot005\,x^2 + 2\cdot8\,x + 8$ for glucose.

$y = -0\cdot0085\,x^2 + 3\cdot75\,x + 4\cdot3$ for invert, calculated for saccharose.—J. F. B.

Succinic Acid in Fermented Liquids, Determination of. J. Laborde and L. Moreau. Ann. Inst. Pasteur, **13**, 657—664. Chem. Centr. 1899, **2**, [16], 794.

From 50 to 100 c.c. of the liquid (according to the proportion of alcohol present) are mixed with about 20 grms. of fine, white sand which has been washed with hydrochloric acid and ignited. The liquid is then evaporated to dryness in a porcelain dish on the water-bath. After cooling, the hard mass is transferred to a 250-c.c.

flask, the dish washed with sand and some ether, and then 100 grms. of small shot and 30 c.c. of ether added. Working in this manner and with agitation, complete exhaustion is attained after three additions of ether, the ethereal extract being each time passed through a filter. The ether is driven off from the extract by distillation, the residue dissolved in a little boiling water, and titrated with 1/10 N potash in presence of phenolphthalein. When the colour change is obtained, an excess of potash is added corresponding to about half the volume already used, the liquid evaporated for the saponification of the glycerin ester, the residue dissolved in water, and the excess of alkali determined by titration with 1/10 N sulphuric acid. From the total amount of alkali used, the percentage of succinic acid may be calculated. It is stated that in other methods, it is overlooked that on evaporating the liquid, succinic acid in presence of glycerin is converted into the glycerin ester, which is not affected by an acidimetric determination.

The method gives results which are somewhat too high (0·1—0·2 per million) in consequence of the incomplete removal of volatile acids by evaporation. This error can be overcome by distilling the liquid, after saturating with potash and adding tartaric acid. The residue is treated as above, the tartaric acid being removed from the ethereal extract as potassium bitartrate.

In incompletely fermented liquids, the sugar is removed by evaporating to a syrupy consistence, and treating with 10—20 cc. of alcohol. The mass is then treated with 50 c.c. of ether in small portions, agitating thoroughly with lead shot, and then the method carried out as described.

—A. S.

Phosphorised Oils, Medicinal, Determination of Phosphorus in. E. Louise. J. Pharm. Chim. **10**, [6], 241—244.

The determination of the amount of phosphorus in an oily menstrum is conducted in a solution of the oil in acetone, aqueous silver nitrate being the precipitant. Under these conditions the precipitation of the phosphorus is strictly quantitative, the fine black precipitate thrown down is easily filtered out, and the end reaction is sharply defined. Two solutions of silver nitrate are employed, one containing 10 per cent. of the salt, the other 1 per cent. The reagent is added to the acetone solution of the oil by means of a Duclaux's drop counter, which discharges exactly a hundred drops of distilled water. A known weight of the phosphorised oil, not exceeding 10 grms., is weighed into a graduated 200-c.c. measure, made up to 200 c.c. with acetone and well mixed. 20 c.c. of the mixture is then measured out into 10 separate test tubes; two drops of the 10 per cent. silver nitrate solution are added to the first tube, the contents well mixed, and the mixture filtered. If the filtrate does not blacken on the addition of another drop of the reagent, the strength of the oil does not exceed one per mille. To determine the exact amount of phosphorus present, one drop of the 10 per cent. solution is first added to each of the remaining tubes, then gradually increasing quantities, drop by drop of the 1 per cent. silver nitrate solution, two drops to the second, three to the third, and so on, the point at which precipitation ceases, after filtration, being noted. If this occurs, for instance, in the fifth tube to which the equivalent of 15 drops of the weaker precipitant has been added, *i.e.*, one drop of 10 per cent. solution and five drops of 1 per cent. solution, the amount of phosphorus per mille will be $\frac{15 \times 0·05036 \times 10}{P}$, where P = the weight of the original oil taken.—J. O. B.

Glue and Gelatin, Notes on. S. Lewites. Protok. St. Petersburger polyt. Ver. 1899, 99.

See under XIV., *page* 1135.

Citronella Oil, Determination of Geraniol and Citronellal in. Schimmel's Semi-annual Report. Leipsic. Oct. 1899, 24—26.

It has been customary hitherto, to base the determination of the value of citronella oil on its total acetylisable constituents. By this process both geraniol and citronellal are determined together. In addition to this, it is now proposed to determine the geraniol separately, taking advantage of the fact that phthalic acid readily reacts with that alcohol, forming an acid ester, but does not react, under the same conditions, with citronellal.

About 2 grms. of the oil, with an equal weight of phthalic acid, and 2 c.c. of benzene, are heated in a small flask on the water-bath, as in acetylising, for two hours. The mixture, when cool, is then shaken for 10 minutes with 60 c.c. of semi-normal KOH solution, the flask being closed with a ground-glass stopper. The excess of alkali is then titrated back with semi-normal H_2SO_4 solution. The amount of alkali requisite to neutralise the amount of phthalic anhydride taken being calculated, the difference between this and the observed figure indicates the amount combined to form geranyl acid phthalate. From this figure the amount of geraniol is deduced. This determined, the equivalent geranyl acetate is deducted from the total acetylation figure, the difference being calculated into citronellal.

By this process, a specimen of the "*Lana Batu*" variety of citronella oil was found to contain 28·2 per cent. of citronellal, 32·9 per cent. of geraniol, and 8 per cent. of methyl-eugenol. This last was determined by Zeisel's methoxyl method.—J. O. B.

Lemon, Bergamot, and Orange; Analysis of the Volatile Oils of the. A. Soldaini and E. Berté. Chem. Zeit. Rep. 1899, [33], 323. From Boll. chim. farmac. 1899, **38**, 537.

Physical characteristics of pure oils are given in the table :—

——	Lemon Oil.	Bergamot Oil.	Orange Oil.
Specific gravity at 15° C.	0·854—0·860	0·882—0·886	0·847—0·853
Rotation at 20° C. in 100 mm. tube.	56°—66°	8°—20°	96°—98°
Boiling point under ordinary pressure.	171°—172° C.	..	173°—174° C.

Lemon Oil.—When 20 c.c. are distilled under 20—30 mm. pressure, the first 10 c.c. should not possess a smaller rotatory power than the original oil. The presence of oil of orange is indicated by a yellow coloration on treatment of a drop of oil with 15—20 drops of brominated chloroform, and by a yellow flocculent precipitate with sodium bisulphite solution; the pure oil gives a white crystalline precipitate. The oil should not contain less than 6·5 per cent. of citral; this constituent is estimated as follows :—5 c.c. of the oil are measured in a pipette divided in $\frac{1}{10}$ c.c., and introduced into a small flask. This has a neck of the same diameter as the pipette, and a side tube bent upwards at right angles. To the oil are added 25 c.c. of potassium bisulphite solution; the pipette is attached upside down to the neck of the flask, and a small funnel to the side tube. The mixture is shaken, warmed 20 minutes on the water-bath; after cooling, again shaken and warmed 5 minutes. When cold, the volume of the residual oil is measured by driving it up into the pipette by adding water by the side tube.

Bergamot Oil.—When 15 c.c. are distilled under 20—30 mm. pressure, the first 5 c.c. should possess $2\frac{1}{2}$ times the rotatory power of the original oil; the next 9·5 c.c. should be almost inactive; the residue, after evaporation on the water-bath, should be 5—6 per cent. The oil is soluble in $\frac{1}{2}$ vol. of 90 per cent. alcohol and the clear solution does not become cloudy on the addition of more alcohol. Schiff's aldehyde reagent should give only a feeble coloration, appearing in half an hour; if a red coloration appears at once, lemon oil is present. The amount of linalyl acetate generally lies between 21 and 22 per cent.; this is estimated by saponifying with an excess of semi-normal caustic potash.

Orange Oil.—The first portion of the distillate from 20 c.c. distilled under 10—20 mm. pressure has a rotatory power from 1° to 2° or even 3° higher than the original oil. Schiff's reagent gives no coloration.—A. C. W.

Lemon Oil, Valuation of. J. Walther. Pharm. Centralh. 1899, **40**, [41], 621—625.

The proposed method is based on the conversion of the aldehydic bodies into oximes, employing for the purpose a known quantity of hydroxylamine, and deducing their amount by the determination of the free hydroxylamine left, after the completion of the reaction. A freshly prepared alcoholic solution of hydroxylamine hydrochloride is used, containing about 1 grm. of hydroxylamine hydrochloride in 20 grms. of 80 per cent. alcohol. 10 to 12 grms. of this solution are diluted to 250 c.c., and 25 to 50 c.c. of this are titrated for hydroxylamine in the usual manner with 1/10 N soda solution, using first methyl orange, and then phenolphthalein as indicators. A second equal weight of the strong hydroxylamine hydrochloride solution is mixed with a weighed quantity of lemon oil, and diluted with absolute alcohol (free from aldehyde) until a clear solution is obtained. After the addition of 0·5 to 1 grm. of sodium bicarbonate, the mixture is introduced into a 150 c.c. flask, and heated on the water-bath for 45 minutes under a reflux condenser. After cooling, the product is washed into a 250 c.c. flask with distilled water, care being taken to wash out the condenser as well as the distilling flask. After thorough shaking out, the watery layer is adjusted to 250 c.c. and 25 c.c. pipetted off. For the determination of the unused hydroxylamine in this, one drop of methyl orange is added, and then dilute hydrochloric acid cautiously run in from a burette until a faint rose colour is developed; the colour is then titrated back with 1/10 N caustic soda solution, phenolphthalein added, and titration continued until the development of the rose colour. The number of c.c. of 1/10 N. caustic soda solution required, after the addition of the phenolphthalein, is multiplied by 10 and subtracted from the amount used for the original hydroxylamine hydrochloride solution. The difference, multiplied by 0·0152 or 0·0154, gives the amount of aldehyde calculated as citral or citronellal. The percentage content may be calculated by the following formula :—

$$C = \frac{1\cdot52 \times a}{g} \text{ or } \frac{1\cdot54 \times a}{g},$$

where C = percentage of aldehyde, *a* = c.c. of 1/10 N caustic soda solution used, and *g* = weight of oil taken.

Employing mixtures of known quantities of citral with turpentine oil, excellent analytical results were obtained. With pure natural lemon oils the amount of citral present was found, by this method, to be about 5 per cent. Care should be taken that the prescribed amount of sodium bicarbonate be not exceeded; excess of hydrochloric acid in the titration should also be avoided, since it is likely to cause saponification of the oxime with the formation of geranic acid.—J. O. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Anhydrous Magnesium Carbonate. R. Engel. Comptes Rend. **129**, [16], 598—600.

By heating the double magnesium-ammonium carbonate in a current of dry air at 120°—140° C., an anhydrous magnesium carbonate, $MgCO_3$, is obtained, containing only traces of ammonia. This substance retains the form of the salt from which it was obtained. Exposed to air, it absorbs moisture as eagerly as quicklime till 3 molecules have been absorbed for each 2 molecules of the anhydrous carbonate. Water, added to it in small quantity, forms with it a solid mass like plaster of Paris; and with additional water the substance is soon completely transformed into the hydrated carbonate $MgCO_3.3H_2O$. One litre of water dissolves 2 grms. of the anhydrous carbonate, but after a while one-half this amount is deposited again in the form of the hydrated salt. In an atmosphere of ammonia gas, the anhydrous substance absorbs more than 100 times its volume (about 1 molecule for 2 molecules of the carbonate); but the gas is given off again on exposure to the air. These properties show that this anhydrous carbonate is essentially different from natural magnesite; the differences are too great to be attributed to mere differences in physical condition.—J. T. D.

Formaldehyde in Plants, Presence of. G. Pollacci. Boll. Chim. Farm. **38**, 601—603. Chem. Centr. 1899, **2**, [19], 881.

The author took leaves of plants, that stood in the light, triturated them with water, and distilled. In the first portion of the distillate, formaldehyde was detected by means of the violet coloration formed on addition of the reagent, codeïne, and concentrated sulphuric acid. This reagent proved extremely sensitive for formaldehyde, particularly for its polymeride, formed by evaporation of the aqueous solution of formaldehyde. Other aldehydes give with codeïne and sulphuric acid a yellow, vanillin and acetone, a green coloration. Also, no other aldehydes that could possibly occur in plants, yield, when allowed to evaporate at the ordinary temperature, a solid, white polymer, as was observed with formaldehyde and the aldehyde isolated from the leaves of plants by distillation. The presence of formaldehyde was also confirmed by means of other reagents. The author considers that he has proved with certainty the presence of formaldehyde in the green parts of the plant.—A. S.

Colouring Matter of Leaves, The Chloroglobin. Tsvett. Comptes Rend. **129**, [16], 607—610.

By making use of the liquefying power of resorcinol, the author has extracted from the leaves of all classes of plants globules of a green substance, behaving towards solvents, saline solutions, colouring matters, and other reagents, like an albuminoid. He regards this substance as a loose compound of chlorophyll and xanthophyll with an albuminoid, as hæmoglobin is composed of hæmatin and albuminoid substance.—J. T. D.

Carob Seeds, The Sugars produced from, during Germination. E. Bourquelot and H. Hérissey. Comptes Rend. **129**, [16], 614—616.

The authors have shown, by separating the embryos from the seeds and allowing them to germinate, that there is produced during the germination a soluble ferment, which, acting on the albumin of the seeds, produces a reducing sugar. By acting on the albumin from 250 grms. of the seeds, they obtained nearly 7 grms. of this sugar, which they proved to consist of mannose and galactose in the proportion (nearly) of 4 to 1. The action of this ferment, then, is the same as that of dilute sulphuric acid (this Journal, 1899, 848).—J. T. D.

Tobacco: Curing and Fermentation of Cigar-Leaf. O. Loew. U.S. Dept. of Agric. Report, 1899, [59]; through Centralbl. Bakt. [II. Abth.], 1899, **5**, 730—734.

During the drying of the leaves the starch is transformed and the greater part of the resulting sugar is consumed by respiration; the proteïds decrease and are replaced by amido bodies; the ethereal extract and tannin also decrease, and changes occur in the colour and aroma. In the subsequent fermentation process, the last traces of sugar disappear, nicotine and nitrates decrease, ammonia and alkalinity increase, and colour and aroma are still further improved. A slow after-fermentation then takes place, resulting in a gradual ripening of the colour and aroma, but if this process be carried too far the tobacco may be spoilt. During or after the fermentation, the tobacco undergoes the process of "petuning," when it is sprinkled with a mordant whose composition is a secret, but which has partly the object of producing ammonium carbonate during fermentation. Hanausek regards this sprinkling as a sowing of bacteria, but the author fails to see that micro-organisms play any part in the process. At any rate the ammonium carbonate increases the alkalinity—a condition which is favourable to the oxidation of the constituents of the tobacco under the influence of the air.

The author regards the processes of loft drying and fermentation as a continued oxidation, which is first started in the respiration processes of the freshly gathered leaves. The purely chemical theory of tobacco fermentation is supported by Schlösing and Nessler, whilst the generally accepted bacterial theory propounded by Suchsland does not commend itself to the author. He points out that the direct evidence of the action of specific bacteria is quite insufficient; they have not been isolated beyond doubt. Only a few spores are present on the leaves—hardly enough to set up a quick and vigorous fermentation. The percentage of moisture in the dried leaves (less than 25 per cent.) is not sufficient to convey soluble nutriment or to allow the activity of micro-organisms; and, finally, the changes which take place during curing are progressively unfavourable to the life of bacteria. According to the author's view, these changes are brought about by the action of oxydases, and, using guaiacum resin, he has observed the presence of an oxydase reacting directly, and destroyed by heating in aqueous solution to a temperature of 65°—66° C., and of a peroxydase reacting in presence of hydrogen peroxide, destroyed by heating at 87°—88° C.; these were present in all parts of the plant. The latter persisted right through the fermentation process in Florida tobacco, but not in Connecticut tobacco, which lost all trace of the former oxydase after the loft drying.

Of the two, the direct acting oxydase plays the greater part in the chemical changes which take place during the curing and fermentation.—J. F. B.

Tobacco: Temperature Changes in Fermenting Piles of Cigar-Leaf. Wittiney, Milton, and Means. U. S. Dept. of Agric. Report, 1899 [60]; through Centralbl. Bakt. [II. Abth.], 1899, **5**, 734—735. (Compare preceding abstract.)

The proportion of moisture in fermenting Florida tobacco should be 23—24 per cent.; 20 per cent. is too little, and with 26 per cent. there is liability to putrefaction. With Florida tobacco, provided sufficient moisture be present, fermentation will take place repeatedly, and each time heat is developed. With Connecticut tobacco, on the other hand, even 27 per cent. moisture is not sufficient to bring about a vigorous second fermentation; with each new fermentation the heating power of this tobacco rapidly decreases. This phenomenon is explained by Loew's observation that oxydase is absent from the loft-dried Connecticut tobacco, and that peroxydase soon disappears in the fermentation process; but that with Florida tobacco the oxydase is not destroyed until fermentation sets in, and the peroxydase even survives that process.—J. F. B.

Oxidation and Hydrolysis of Organic Substances, Simultaneousness of, under the Action of Free Oxygen and Sunlight. Berthelot. Comptes Rend. **129**, [17], 627—636.

Four flasks were taken: in each was placed a sealed tube containing 7 grms. of pure ether; to two were added 10 c.c. of water, to the others 10 c.c. of a solution of hydrogen peroxide; all the flasks were now sealed and the ether tubes were broken. One flask of each pair was kept in the dark, the other exposed to sunlight, for five months. At the end of that time, the substances in the flasks kept in the dark had undergone practically no change. In the others, the gaseous contents were nitrogen, methane, and ether vapour, the liquid contents aldehyde, alcohol, and acetic acid, besides unchanged ether and water; there was no ethyl acetate, and no hydrogen peroxide remained. The quantitative results in the two cases were as follows:—

—	Ether, Air and Water.	Ether, Air, Water, and Hydrogen Peroxide.
	Grm.	Grm.
Total oxygen consumed	0·060	0·260
Methane found	0·005	0·006
Acetic acid found	0·053	0·200
Alcohol found	0·08	0·26

The acetic acid accounts in each case for about half of the oxygen consumed, the remainder having gone to form aldehyde and other products which were not determined. The formation of alcohol by direct hydrolysis of the ether, or by formation and hydrolysis of ethyl acetate, appears to be out of the question; nor would the formation and subsequent splitting up of ethyl peroxide account for the proportion of alcohol to acetic acid found. The mechanism of the action is obscure, but the fact that the oxidation of the ether to acetic acid is accompanied by the hydrolysis of a larger quantity to alcohol is established.

In a second similar set of experiments in which ether and water, with and without free oxygen, were kept in darkness and exposed to sunlight for seven weeks, there was no action save in the case in which air and sunlight acted conjointly. Here the action, though less in amount than in the former series, was similar; the hydrolysis was more marked than the oxidation.

In a number of tubes of ether, sealed up in 1882, and opened now, no change had taken place. In a bottle filled at the same time, where evaporation of ether and entrance of air by the stopper had occurred, the contents were found to be as in the second column of the table below:—

—	Amount.	Oxygen Absorbed.	Ether Destroyed.	Water Formed.
	Grms.	Grm.	Grms.	Grm.
Ether	0·0	..	..	..
Ethyl acetate	1·9	0·73	1·6	+ 0·41
Alcohol	2·6	..	2·1	− 0·50
Acetic acid	0·6	0·32	0·37	+ 0·09
Water	0·9	..	..	+ 0·90

Here also the amount of alcohol formed is far more than equivalent to the acetic acid formed at the same time.

This simultaneous hydrolysis and oxidation, observed in the case of ether, probably occurs in the case of many animal and vegetable substances, such as sugars and other carbohydrates, glucosides, glycerides, ureïdes, &c., and not merely in the case of purely chemical actions, but also in physiologico-chemical transformations taking place in the bodies of plants and animals.—J. T. D.

PRESENTATION OF THE DAVY MEDAL OF THE ROYAL SOCIETY TO DR. EDW. SCHUNCK, F.R.S.

(*President of the Society of Chemical Industry* (1896–97).)

On Nov. 30 the Davy Medal of the Royal Society was presented to Dr. Edward Schunck, F.R.S., for his investigations on madder, indigo, and chlorophyll.

New Books.

Lexicon der Kohlenstoff-Verbindungen. Von M. M. Richter. Zweite Auflage der "Tabellen der Kohlenstoffverbindungen nach deren empirischer Zusammensetzung geordnet." Dreizehnte bis 17te Lieferung. Verlag von Leopold Voss, Hamburg and Leipsic. 1899. Price M. 1·80 per each Part (Lieferung). Williams and Norgate, 14, Henrietta Street, Covent Garden, London. H. Le Soudier, Paris. G. E. Stechert, New York.

See this Journal, 1899, 954. Lieferungen 13 to 17 of this Lexicon may now be obtained.

Introduction to Physical Chemistry. By James Walker, D.Sc., Ph.D., Professor of Chemistry in University College, Dundee. Macmillan and Co., Limited, London. 1899. Price 10*s*. The Macmillan Company, New York.

This work is designed for the student who has already taken ordinary courses in chemistry and physics, and desires a clear and explanatory introduction to the larger systematic works of Ostwald, Nernst, and van't Hoff. It contains 332 pages of subject-matter with 47 illustrations, and is terminated by an alphabetical index. The following subjects are dealt with in the text:—I. Units and Standards of Measurement. II. Atomic Theory and Atomic Weights. III. Chemical Equations. IV. The Simple Gas Laws. V. Specific Heats. VI. The Periodic Law. VII. Solubility. VIII. Fusion and Solidification. IX. Vaporisation and Condensation. X. Kinetic Theory and Van der Waal's Equation. XI. The Phase Rule. XII. Thermochemical Change. XIII. Variation of Physical Properties in Homologous Series. XIV. Relation of Physical Properties to

Composition and Constitution. XV. Properties of Dissolved Substances. XVI. Osmotic Pressure and the Gas Laws for Dilute Solutions. XVII. Deductions from the Gas Laws for Dilute Solutions. XVIII. Methods of Molecular Weight Determination. XIX. Molecular Complexity. XX. Electrolytes and Electrolysis. XXI. Electrolytic Dissociation. XXII. Balanced Actions. XXIII. Rate of Chemical Transformation. XXIV. Relative Strengths of Acids and Bases. XXV. Equilibrium between Electrolytes. XXVI. Applications of the Dissociation Theory. XXVII. Thermodynamical Proofs.

A Text Book of Physical Chemistry. By Dr. R. A. Lehfeldt. Professor of Physics at the East London Technical College. Edward Arnold, 37, Bedford Street, London, W.C. Price 7*s.* 6*d.*

Small 8vo volume containing preface, table of contents, lists of symbols of quantities, and of physical constants. The subject-matter fills 305 pages and there follows an alphabetical index, which concludes the work. There are 40 illustrations. The branches of the subject treated are as follows:—Introduction. I. Determination of Molecular Weight. II. Physical constants in relation to Chemical Constitution. III. Principles of Thermodynamics. IV. Chemical Dynamics of Homogeneous Systems. V. Chemical Dynamics of Heterogeneous Systems. VI. Application of Thermodynamics to Chemical Equilibrium. VII. Electro-Chemistry.

Descriptive General Chemistry. A Text Book for Short Course. By S. E. Tillman, Professor of Chemistry, Mineralogy, and Geology, United States Military Academy. 2nd Edition. John Wiley and Sons, New York, U.S. America. Chapman and Hall, Limited. London. 1899. Price 12*s.* 6*d.*

8vo volume, with preface, table of contents, and text filling 411 pages and concluded by an alphabetical index. Fifteen illustrations. It is a form of instruction book in which both chemistry and its applications are treated in an elementary way, the different divisions of the work being devoted to the following subjects:—I. Essential Principles of Chemistry, pages 1—58. II. Affinity, pages 59—81. III. Non Metals, pages 82—192. IV. Metals, pages 193—310. V. Organic Chemistry, pages 311—356. VI. Applications of Chemistry, pages 357—411.

Dairy Chemistry. Practical Handbook for Dairy Chemists and others having Control of Dairies. By Henry Droop Richmond. Analyst to the Aylesbury Dairy Co., Limited. Chas. Griffin and Co., Limited, Exeter Street, Strand, London, W.C. 1899. Price 16*s.*

This work takes the form of an 8vo volume, containing preface, table of contents, 356 pages of subject-matter, including 84 tables, a list of useful books and periodicals for consultation, and the alphabetical indexes of subjects and of names of authors, &c. The divisions of the general subject adopted, are as follows:—I. Constituents of Milk. II. Analysis of Milk. III. Normal Milk, its Adulterations and Alterations, and their Detection. IV. Chemical Control of the Dairy. V. Biological and Sanitary Matters. VI. Butter. VII. Other Milk Products. VIII. The Milk of Mammals other than the Cow. Appendix A. Experimental evidence that the Fat in Cream is solid at low temperatures, &c. There are 22 illustrations.

Modes Opératoires des Essais du Commerce et de l'Industrie. Leçons Pratiques d'Analyse Chimique faites aux Laboratoires Bourbouze. Par L. Cuniasse et R. Zwilling, avec Preface de M. Ch. Girard. Georges Carré et C. Naud, Editeurs, 3, rue Racine, Paris. 1900. Price Fr. 6.

This is a small work, containing 279 pages of subject-matter, table of contents, and alphabetical index. It treats chiefly of the analysis of Technical products, such as Alkalis, Lime, Cements and Mortars, Iron, Zinc, Copper, Silver and its alloys, Mercury, Lead, Alloys of Gold, Manures, Pyrotechnic Mixtures, and Glass. Also organic substances, such as Flour, Sugar, Petroleum and Mineral Oils, Creosote, India-rubber, Gutta-percha, Coal-tar Colours, Fatty Matters, Milks, Soaps, Paper, Leather, Vinegars, Beers and Spirits, &c. There are 48 engravings.

Indicators and Test-Papers: Their Source, Preparation, Application, and Tests for Sensitiveness. A Résumé of the Current Facts regarding the Action and Application of the Indicators and Test-papers which have been Proposed from Time to Time, and are in Present Use in Chemical Manipulations, with a Tabular Summary of the Application of Indicators. Designed for the Use of Chemists, Pharmacists, and Students. By Alfred I. Cohn, Ph.G. First Edition. John Wiley and Sons, New York, U.S. America. Chapman and Hall, Limited, London. 1899. Price 8*s.* 6*d.*

Small 8vo volume, with preface, table of contents, and subject-matter, filling 224 pages, a tabular Summary of Principal Indicators, indicating their comparative value and efficiency, and the Alphabetical Index. The work is subdivided as follows:—I. Introduction, with General Considerations, Correct Choice of, Application of, Action of Indicators, also Theory of the Action. II. Indicators, Description of, Preparation, and Properties of. III. Test Papers. IV. Tables. Trommsdorff's, Thomson's and Dieterich's Tables, and the Tabular Summary already referred to.

Determination of Radicles in Carbon Compounds. By Dr. H. Meyer. Authorised translation by J. Bishop Tingle, Ph.D. John Wiley and Sons, New York, U.S.A. Chapman and Hall, Ltd., London. 1899. Price 4*s.* 6*d.*

The following subjects are dealt with in this little work (120 pages):—(I.) Determination of Hydroxyl; (II.) of Methoxyl $CH_3\overset{|}{O}-$, Ethoxyl, $C_2H_5\overset{|}{O}-$; (III.) of Carboxyl; (IV.) of the Amine group, &c., &c.; (V.) of the Diazo group, &c., &c.

Trade Report.

TARIFF CHANGES AND CUSTOMS REGULATIONS.

Germany.

Tariff Decisions.

The following tariff decisions of the Bundesrath have been communicated to the Board of Trade by the Foreign Office:—

Aluminium, cast in sheets, is to be classed with raw aluminium in blocks and bars, and admitted free of duty under sec. 19 (a) of the Tariff.

Undyed cotton yarns which have received a gloss resembling silk through the use of chemical materials are to be treated for tariff purposes as bleached yarns.

Tissues waterproofed with other materials than india-rubber or gutta-percha are to be classed with bookbinders' cloth and leather cloth—duty, 30 marks per 100 kilogrammes.

Pegamoid, and wares thereof, are to be treated, for tariff purposes, as celluloid and celluloid wares, according to class.

All white purified soda is, for tariff purposes, to be treated as "calcined soda," and subject to duty at the rate of 2 marks 50 pf. per 100 kilogrammes gross.

Vaselin oil, perfumed, is to be classed as perfumery not specially mentioned in the Tariff—duty, 100 marks per 100 kilogrammes.

British Honduras.

Export Duty on Logwood.

An Ordinance of the Government of British Honduras (No. 13 of 1899) reimposes the export duty of 50 cents per ton on logwood, which was abolished in 1897.

CANADA.

Tariff Decisions.

The following decisions of the Canadian Board of Customs have been approved by the Minister of Customs :—

Tariff No.	Article.	Rate of Duty *ad valorem.*
		Per Cent.
25	Barilla soap	35
5	Cocoacola, an article used with soda water as a flavouring for summer drinks, and containing no more than 25 per cent. of proof spirits.	(per gallon, 60 cents)
158	Lithopone, "commercial zinc white"	5
158	"Charlton zinc white"........................	5
272	Antimonial lead, in pigs—provided, however, in respect of any importation of the above article that if it is established by analysis to contain over 12 per cent. of antimony, the importation shall be classed as babbit metal or type metal.	15

INDIA.

Imp. Inst. J., Dec. 1899, 328.

Additional Duties on Sugar from France.—The Board of Trade have received, through the India Office, copy of a Customs Circular (No. XIV. of 1899), by which the rates of additional duty levied on sugar imported into India from France, are revised as in the following table :—

Schedule of Revised Rates.

Kinds of Sugar.	Bounties bestowed.	Additional Duties to be levied.		
		Per Cent.		
		R.	A.	P.
Raw sugars from 65 to 98 per cent. polarisation for beetroot sugars, or 65 to 97 per cent. for French Colonial sugar.	11.16 francs per 100 kilos. of refined sugar of 100 per cent. polarisation.*	3	5	11
Sugar candies	11.95 francs per 100 kilos.	3	9	9
Refined sugars in loaf or crushed, clear, hard, and dry.	11.95 francs per 100 kilos.	3	9	9
Raw and refined sugars in grains or crystals of a minimum standard of 98 per cent. polarisation.	11.56 francs per 100 kilos.	3	7	10

Schedule of Superseded Rates.

Kinds of Sugar.	Bounties bestowed.	Additional Duties to be levied.		
		Per Cent.		
		R.	A.	P.
Raw sugars from 65 to 98 per cent. polarisation for beetroot sugars, or 65 to 97 per cent. for French Colonial sugar.	10.82 francs per 100 kilos. of refined sugar of 100 per cent. polarisation.*	3	4	0
Sugar candies.............	11.51 francs per 100 kilos.	3	7	6
Refined sugars in loaf or crushed, clear, hard, and dry.	11.51 francs per 100 kilos.	3	7	6
Raw and refined sugars in grains or crystals of a minimum standard of 98 per cent. polarisation.	11.17 francs per 100 kilos.	3	6	0

* The output of refined sugar from raw is computed by deducting from the polarisation of the raw sugar twice the glucose, four times the ashes, and 1½ per cent. for loss in refining.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS.

ANILINE COLOURS AND CHEMICALS IN GERMANY IN 1898.

U.S. Cons. Reps., Nov. 1899, 380.

The workmen employed in chemical factories make good wages. This branch of industry is still in good condition, although the efforts of foreign countries to make themselves independent of German chemical supplies are beginning to be felt. The United States especially is striving in this direction; so much so that several large German establishments were compelled to establish branch factories in America, in order to retain their business. Those making aniline colours have less to fear, as it will be some time before Americans learn the secrets of their manufacture. The export of aniline colours forms an important item in German foreign trade. It increased from 53,200,000 marks in value in 1894 to 72,000,000 marks in 1898. Of this amount, the United States took 15,600,000 marks' worth; England, 14,600,000 marks; Austria-Hungary, 7,000,000 marks; Italy, 4,500,000 marks; and China, 5,400,000 marks.

KID SKINS, AND THEIR SOURCES.

U.S. Cons. Reps., Nov. 1899, 367.

This industry may be divided into four main departments, *viz.*: (1) The raw-skin business; (2) the dressing or alum-tanning process; (3) the dyeing or staining process; (4) the actual glove-making.

Kid Skins.

The quality of the skin is best judged after the tanning and dyeing process is complete, and is based on the strength, softness, and pliability of the leather, and on the size of the skin, the fineness of the grain, and its freedom from defects, which are mainly caused by scars or diseases. These qualities of the raw skin depend on the care given to the young kid, on its breed, on the nature and abundance of its food, and on climatic influences.

The finest kid skins are found in France, but French skins are not uniform in quality. In Savoy the skins are large and heavy, with a fine grain for the size; they are soft and elastic, and at the same time strong and well suited for men's gloves. This is due to the rich pasturage.

In the Vosges, kid skins are much smaller and less elastic, owing to the fact that the animals are not so well cared for. On the line between Paris and Lyons, the kid skins are of a better quality. In Touraine and Poitou, where the pasturage is good and the animals well cared for, the grain of the skin is fine, the skin itself is thin and strong. Further south, towards the Spanish frontier, the quality of the skin is inferior owing to poorer pasturage and hotter climate. The peasants neglect the kids while alive, take the skins off carelessly, and prepare them in a slovenly manner. At least one-third of these skins are so dry that they are fit to be used only as linings for boots and shoes. Kid skins are the same throughout the south-west of France.

The leading fairs in France, where kid skins are particularly in evidence, are held at the following places :—Romans (Drôme), Anneyron (Drôme), St. Marcellin (Isère), Valence (Drôme), Clermont (Oise), Tours (Indre et Loire), Poitiers (Vienne), Lusignan (Vienne), Riom (Puy de Dôme), Aurillac (Cantal), Chalons-sur-Saône (Saône-et-Loire).

In Italy, the finest kid skins, many of them equal to the best French skins, come from the north, above the line from Turin to Venice. A heavy, coarse skin is found in the neighbourhood of Genoa, and a finer, smaller skin in Tuscany. Naples, a great centre for the manufacture of cheap gloves, is noted for a low-grade skin, as well as Sicily, Sardinia, and Corsica; those that come from the Abruzzi district, north-east of Naples, are better.

Switzerland stands next to France in the high quality of skins produced.

Spain and Portugal both produce large quantities, but, as a rule, they are far inferior even to those of Southern France. The best Spanish skins are to be found in Saragossa and the surrounding country.

Germany produces a large number of kid skins, of which the best come from Saxony. Bavaria, Baden, Thuringia, and Silica furnish large quantities.

The best Austrian skins are to be found in the Tyrol and Styria: those from Bohemia, Hungary, and Transylvania are not so good.

Kid skins from eastern Europe, northern Africa, South America, and Mexico are used principally in the manufacture of Suède gloves. The inferiority of these skins is due chiefly to the fact that the kids are poorly fed and neglected while alive, and the skins carelessly torn off and allowed to dry in the sun.

COMPARATIVE VALUE OF BRITISH, GERMAN, AND FRENCH IMPORTS INTO SWITZERLAND DURING 1897 AND 1898.

Foreign Office Misc. Series, No. 516, Oct. 1899.

Category.	Description.	Great Britain.				Germany.				France.			
		1897.	1898.	Increase.	Decrease.	1897.	1898.	Increase.	Decrease.	1897.	1898.	Increase.	Decrease.
		£	£	£	£	£	£	£	£	£	£	£	£
4	Mineral produce	28,692	24,748	..	3,944	1,306,259	1,577,742	271,483	..	606,600	605,336	..	1,264
5	Copper and brass goods	14,138	12,329	..	1,809	336,214	416,001	79,787	..	135,572	196,322	60,750	..
7	Leather, boots, and shoes	78,468	75,448	..	3,020	544,979	544,208	..	771	200,649	212,923	12,274	..
11	Chemicals and druggists' sundries.	55,226	55,062	..	164	519,504	541,597	22,093	..	152,926	158,717	5,791	..
13	Gold, silver, plated goods, and jewellery.	10,885	21,450	10,565	..	546,824	496,448	..	50,376	1,197,101	1,202,603	5,502	..
14	Aluminium, zinc, and tin goods	25,412	18,877	..	6,535	116,604	124,904	8,300	..	73,922	89,539	15,617	..
15	Pottery goods	14,074	18,059	3,985	..	151,874	160,392	8,518	..	112,100	133,327	21,227	..
19	Paper goods	12,001	13,298	1,297	..	203,196	234,416	31,220	..	35,919	40,119	4,200	..
20	Manures, rags, and fodder	588	11	..	577	222,585	262,928	40,345	..	133,491	119,240	..	14,251
21	Colouring materials	12,541	12,470	..	71	182,725	176,329	..	6,396	28,570	32,785	4,215	..
22	India-rubber and gutta-percha goods.	24,203	29,260	5,057	..	50,549	59,503	8,954	..	7,588	10,762	3,174	..
23	Glassware	1,222	966	..	256	75,068	70,889	..	4,179	34,234	40,225	5,991	..
25	Oils, soaps, and fats (*for details, see below*).	33,706	29,906	..	3,800	37,786	38,805	1,019	..	153,472	189,844	36,372	..
	Total of all categories	2,161,746	2,038,351	42,414	165,809	12,254,838	12,584,460	652,750	323,128	7,696,651	8,157,270	503,633	43,014
				Decrease 123,395				*Increase* 329,622				*Increase* 460,619	

Category 25.—Oils, Soaps, and Fats.

	Value.			
	1897.	1898.	Increase.	Decrease.
	£	£	£	£
Oil, in bottles	10	..	..	10
Linseed oil, in barrels	1,710	714	..	996
Oils for various trade purposes.	9,089	12,467	3,378	..
Tallow	900	3,981	2,081	..
Cod-liver oil, spermaceti.	493	..	..	493
Candles	554	646	92	..
Ordinary soap	18,950	10,013	..	8,937
Perfumed soap	2,000	1,841	..	159
Various	..	244	244	..
Total	33,706	29,906	6,795	10,595
Actual decrease in 1898	..	..	3,800	

EXPORTS OF INDIA-RUBBER FROM ANGOLA (PORTUGUESE SOUTH-WEST AFRICA).

Foreign Office Annual Series, No. 2363, Nov. 1899.

Year.	Quantity.	Value.
	Tons.	£
1881	355	52,528
1882	275	52,225
1884	..	64,552
1885	..	44,864
1888-91 (four years)	6,316	..*
1895	2,106	327,064
1896	2,286	374,454

* Not stated.

The statistics available for the years 1897 and 1898 show that in the former year 2,810 tons of rubber of a declared customs value of 583,227*l*. were shipped from Angola, and in 1898, 3,377 tons, valued at 887,262*l*.—this out of a total export trade of all commodities for the latter year of 1,135,549*l*. The export of rubber alone in 1898 almost equalled the value of the entire export trade of the colony in the previous year.

The appended table shows the distribution of the rubber export for 1898:—

Port.	Quantity.	Value.
	Kilos.	£
Benguela	2,250,095	604,923
Loanda	1,105,075	275,159
Ambriz	11,939	3,559
Mossamedes	10,754	3,621

While prices of rubber have risen, and now stand at more than double the quotation of 10 years ago, the yield of the commodity from Angola has more than trebled.

Turning to the neighbouring Congo Independent State a study of its dealings in rubber presents an even more remarkable increase. In 1887 the exports of caoutchouc from the Congo were valued at 4,671*l*. In 1898 they had increased to 634,000*l*., out of a total export trade of all kinds of 887,000*l*. The quantity shipped from the Congo State in 1898 is stated to have been 2,113½ metric tons, less by 136½ tons than that exported from Benguela alone, and less by 1,264½ tons than the quantity Angola as a whole exported in 1898.

The absence of system by which Angola put nearly 4,000 tons of india-rubber on the European markets last year is one which, if pursued, must bring about a comparatively early stoppage of the means of supply. The native gathers rubber when, where, and how he will. Thus, while the quantity of india-rubber shipped from the Congo and Angola ports of late years shows so rapid an increase, the area of devastation spreads annually at a still more rapid rate.

The tendency of the method of collection, in force upon the Congo, has already attracted the attention of the authorities there, and steps are now being taken not only to limit the extent of present loss due to hasty and avaricious collectors, but to maintain as far as possible the means and area of supply. It is now ordained by a decree of the Government of the Congo State that each firm exporting rubber from its territories shall plant a certain number of fresh trees in proportion to its shipments of that article. This measure, strictly enforced on all alike, should prove of the very greatest benefit to the future trade in rubber from the vast territories drained by the Congo.

In addition to legislation for preventing the destruction and ensuring the reproduction of rubber-giving plants, the Congo Government has itself caused fresh varieties of rubber plants to be imported, and is, through its own agents, paying attention to their distribution and cultivation. Among such plants may be mentioned the ***Ficus Elastica***, the Ceará or ***Manihot Glaziovii***, and the ***Hevea Brasiliensis***. Should nothing of the kind be done in Angola the trade in rubber cannot continue to prosper.

In the Congo State owing to the great energy of its officials, and the widespread ramification of its internal water systems, permitting an easier occupation and control of large native communities, quicker results may be looked for. These conclusions are supported by a recently published review of the india-rubber output of Portuguese East Africa issued by Her Majesty's Consulate at Lourenço Marques.

CHEMICAL INDUSTRIES OF MEXICO CITY AND DISTRICT.

Foreign Office Misc. Series, No. 517, Nov. 1899.

Raw Materials and Power.

Throughout the whole of the Valley of Mexico, rivers are of very little service as motive power, though there are a few factories situated on the south-western and southern slopes of the mountains that are able by means of dams to procure the necessary power to move their machinery.

During the months of March, April, and May the supply of water from the rivers is diminished to such an extent that the factories have to rely upon steam power.

Industries.

The city of Mexico, although the largest commercial and distributing centre in the Republic, cannot be considered a manufacturing district, as will be observed from the following table, which gives the number of factories and other industries within its limits:—

Factories and Industries.	Number.		
	City.	Suburbs.	Total.
Print works	3	1	4
Paper	..	3	3
Bricks and manufactured clay	1	2	3*
Compressed cement tiles	1	..	1
Breweries	1	..	1
Distilleries	6	..	6†
Potteries	2	..	2
Tobacco	4	..	4†
Chemicals	4	..	4
Iron and brass foundries	5	1	6
Petroleum refineries	1	..	1

* Does not include native brick kilns.
† Does not include small establishments.

Candles are nearly all of Dutch or Belgian manufacture. English composite candles, as a rule, are higher in price than those of Continental manufacture. There are two stearine candle factories in the city. Candles used in the Roman Catholic churches and cemeteries are made of native wax.

Chemicals.—In the Customs tariff, the heading of chemicals includes all kinds of drugs, patent medicines, perfumes, colours, &c., and as this seems to be a branch to itself the same heading is now employed to cover the same articles, which are obtained in all the large wholesale and retail druggists. There are 12 of these establishments in the city of Mexico, two of which also have factories for making acids and chemicals. There are five manufacturers of fancy soaps and perfumery, whose products are a very close imitation of European marks.

There are several chemists, the principal being Germans and Mexicans, but in many of the large druggist establishments a responsible professor of chemistry, appointed by the Board of Health, is always on hand for such services as may be required.

Glass, China, and Earthenware.—There are 11 glass, china, and earthenware establishments in the city, two of which deal exclusively in glassware of native manufacture. Five others are agents for native pottery factories situated principally in the State of Puebla. Another is a large establishment formed with Mexican capital; it imports all its glassware, but a great deal of the china and earthenware is made in its own factory, which is well equipped with modern machinery, and many of the workmen are English potters from Staffordshire.

The three remaining establishments (one Swiss, one German, and one French) carry very large assortments imported from France, the United States, Germany, and England, including the ordinary table wares, statues, vases, and all kinds of ceramic ware for ornamental purposes.

There are three paper factories in the federal district, one British, one Spanish, and one Mexican, and also three cardboard factories owned by Mexicans.

The newspapers that are published in the city (three edited and controlled by Americans) with very few exceptions employ home-made paper. This being of an inferior quality suits them better than foreign printing paper which is too expensive for cheap literature, the price of some of the daily papers being only 1 cent (¼*d.*).

There are seven houses dealing in wall papers, carrying selections made in France, Switzerland, Germany, Great Britain, and the United States. This trade is not confined to special houses, as large assortments are kept in stock by the leading druggists, drapers, and stationers.

Trade Marks.

As a general rule those British houses whose trade marks are registered in Great Britain have omitted to have them also registered in the commercial register of Mexico.

It can scarcely be considered as an oversight, as the attention of British manufacturers has more than once been called to this fact, not by their agents but by merchants of this city, who, though receiving the genuine article direct from the factory, are unable to compete in price with the imitations made in this country or imported. No action can be taken in many of these cases, either by the commission agent, or by the merchant who carries the stock, and they have to allow the fraudulent production to remain on the market. The general public when they find that they have been deceived, usually make a claim upon the merchant who deals in the genuine article, with the result that his sales are affected and his reputation questioned, through no fault of his own. Such being the state of things, the attention of manufacturers and dealers is seriously called to the advantages of having their trade marks properly registered, under the regulations of the "Trade Mark Law" of Mexico, for their own protection.

As shown by figures published in the trade report for the year 1898 the imports from Great Britain in that year were $17\frac{3}{4}$ per cent. of the total imports into Mexico, which is about 1 per cent. under the average for the past five years. Those of France were 12 per cent. in the same year, as against an average of 14 per cent.; while Germany, whose commerce is extending very considerably, sent $11\frac{1}{2}$ per cent. of the total merchandise. This amount was $1\frac{1}{2}$ per cent. in excess of the average of the past five years.

Mexico, whose steady progress during the past 20 years has more than once been remarked upon, and whose ports have been opened to the traffic of all the world, is now a field for new enterprises. Industries and commerce are open for investment of capital, and companies properly managed by able men, would yield as good a return as in any other country.

THE TRADE OF HAMBURG IN 1898 IN WAR MATERIAL AND EXPLOSIVES.

Bd. of Trade J., Dec. 1899, 675.

A memorandum on the trade of Hamburg in 1898 explosives has been received at the Board of Trade, to which is annexed the following table containing a statement of the respective values of gunpowder and dynamite exported by sea from Hamburg in 1898. The most extensive shipments of explosives were made to Australia, Cape Colony, United Kingdom, China, Japan, Spain, Greece, Chile, and the United States.

It will be seen by the figures at the foot of the following table that, whilst the annual value of the total shipments of gunpowder from Hamburg has been gradually increasing during the past three years, that of the total shipments of dynamite and other explosives has experienced a gradual diminution. Nearly all of the explosives exported from Hamburg are manufactured in North Germany. In the vicinity of Hamburg there are several large establishments for the manufacture of dynamite, various kinds of gunpowder, and other explosives.

Besides the exports of explosives by sea, considerable quantities of these products are sent from the district to the interior of Germany and also to Austria by rail and river.

Exports from Hamburg of Explosives in 1898.

——	Gunpowder.	Dynamite and other Explosives.
	£	£
Great Britain and Ireland	..	22,554
German, Baltic, and North Sea Ports	..	12,585
Russia	..	13,921
Sweden	431	9,821
Norway	931	689
Portugal	..	720
Spain	21,083	2,892
Greece	24,509	649
European Turkey	8,529	..
United States of America	18,132	1,053
Mexico Atlantic Coast	..	3,394
,, ,, ,,	..	3,358
Brazil	5,874	4,214
Argentine Republic	1,884	740
Chile	38,821	15,192
Bolivia	587	5,922
Peru	4,310	10,943
German W. Africa	5,458	..
,, S.W. Africa	..	565
Other parts of W. Africa	34,610	..
Cape Colony	..	41,053
Other parts of E. Africa	..	1,151
South African Republic	..	1,235
British India	107	367
Straits Settlements	735	3,161
Dutch India	1,231	1,641
China	5,693	21,069
Japan	12,843	32,442
Australia	245	47,479
Other countries	5,096	4,804
Total for 1898 £	192,063	263,614
Total for 1897 £	124,380	310,950
Total for 1896 £	83,424	376,434

GERMAN PRINTING PAPER.

U.S. Cons. Reps., Nov. 1899, 498.

Up to 1896, Germany's printing-paper exports had a rapid annual increase. Since that time, a falling off has been noticeable. In the 10 years 1886—1896, the exports had about doubled. In 1896, they were 378,182 double centners,* worth nearly 2,230,000 dols.; in 1897, they were 321,368 double centners, worth 1,904,000 dols.; in 1898, they had dropped to 295,353 double centners, worth 1,761,200 dols. The cause of this falling off is found in the competition of United States paper makers. In 1896, Germany sent 10,490 double centners to the United States and in 1898 only 2,617 double centners. Germany's exports of printing paper to Great Britain have fallen off since 1896 fully one-third. The decrease in exports of printing paper to Holland is even comparatively larger. A falling off was recorded in the exports to Australia and South America. The Argentine Republic and Japan are the only countries in which an increase was recorded. In 1898, 38,360 double centners were sent to Argentina and 40,743 double centners to Japan, against 30,927 double centners and 20,656 double centners respectively, in 1896. If the markets to which Germany sends paper are carefully canvassed, there is no reason why our exports in this line should not continue to increase.

GERMAN BEET-SUGAR INDUSTRY IN 1898-99.

U.S. Cons. Reps., Nov. 1899, 393.

The official report of the year just closing shows, upon the whole, satisfactory results. There was some decrease of production in the sugar fields, but there was no material decrease in the final results. The good prices realised for raw sugar during the last months more than compensated for the low prices ruling earlier in the season.

The acreage of the year 1899 which is to supply the beet material for the new campaign (1899—1900) now to begin, shows only the very slight increase of 0·35 per cent. over last year. The German beet-sugar industry has come to a standstill, as may be seen from the following table of the areas cultivated:—

	Acres.
1896-97	1,050,000
1897-98	1,080,000
1898-99	1,054,000
1899-1900	1,058,000

The crop of beets grown amounted to 12,144,291·4 metric tons* in 1898, which was 1,553,691·4 metric tons less than the year before. As the German farmer calls 12 metric tons per acre a fair average crop, he was not so well pleased, as he averaged only 11½ tons. But while the quantity did not come up to the expectations, the quality of the beets was superior to that of the preceding year. The German beet had never before been so sweet; its sugar contents amounted to 13·36 per cent. The result was that almost as much sugar was produced in 402 factories from this short crop of beets as was ever produced before, *viz.*, 1,623,025 metric tons, which is 1·705 metric tons of raw sugar per acre.

The German farmer received, on the average, 4 dols. per metric ton for his beets, and the German sugar manufacturer, on the average, 49·50 dols. per ton for his raw sugar.

BEET ACREAGE IN RUSSIA IN 1899.

U.S. Cons. Reps., Nov. 1899, 408.

The area devoted to the cultivation of beets in European Russia at the end of May 1899, amounted to 1,212,972 acres, against 1,083,758 in 1898, an increase of 129,214 acres, or 11·9 per cent.; of that amount 801,935 acres belonged to the planters and 411,040 to factories.

BEETROOT CROP OF 1899 IN RUSSIA.

Foreign Office Annual Series, No. 2366, *Nov.* 1899.

The total area of beetroot sown in 1899, corrected by the Russian Society of Sugar Manufacturers as at 13th September, was given as 1,269,551 acres, less 55,536 acres reploughed, thus leaving 1,214,015 acres; an increase over last year of 110,404 acres.

The above area is estimated to yield 7,039,630 tons of beetroot, as against 5,770,218 tons last year. The average yield per acre would therefore be 116 cwts., as against 104½ cwts. in 1898, 116 cwts. in 1897, and 121 cwts. in 1896.

The quantity of sugar expected to be produced from the above yield is calculated at 929,032 tons, or 279,181 tons more than at the same date in 1898.

In comparing the yield of sugar from the beetroot, we find that it will require 7·57 tons of roots to produce one ton of sugar, as against 8·88 tons in 1898, 9·54 tons in 1897, and 8·31 tons in 1896. In other words, the percentage of sugar extracted from the roots seems practically to increase yearly.

The quantity of sugar fixed by the Ministry of Finance for home consumption from the present campaign is 572,581 tons, or 24,193 tons more than last year, and by adding to the above the quantity for "inviolable reserve" of 56,452 tons, or together, 629,032 tons, there will be the large quantity of 300,000 tons of sugar to be exported (the most of which will no doubt be sent to Great Britain) at the prices ruling on the purchasing markets!

Assuming the quantity of sugar estimated to be produced from the present campaign as being correct, and taking the production of the other beetroot sugar countries of Europe, as estimated at same date for 1898 campaign, we find that the production of sugar in Russia now exceeds that of Austria Hungary or France, and that Russia now holds second place to Germany, which produces as much as Austria and France together.

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* 1 double centner = 220·46 lb.

* Of 2,204·6 pounds.

GENERAL TRADE NOTES.

Copper Consumption in Germany.

Comm. Intelligence, Dec. 23, 1899.

Owing to the development of the electrical industries in Germany, the increase in the consumption of copper and lead appears to be greater than in any other country. In 1897 the consumption of copper was 92,148 tons, and that of lead 133,239 tons, while in 1898, the consumption of copper was 98,160 tons, and that of lead 159,229 tons. Germany produces 7 per cent. of the world's supply of copper, and consumes 22½ per cent., while its production of lead is 17½ per cent. of the world's supply, and its consumption 20 per cent.

New Methods of Business in Russia.

Bd. of Trade J., Dec. 1899, 729.

The French Consul at Odessa gives some hints to commercial travellers that may be interesting to paper manufacturers who are pushing their export trade. The Consul points out that all endeavours to build up a market of any importance by the ordinary methods having failed, several large French firms adopted a quite novel method which proved unexpectedly successful. Starting, for instance, in Poland, the commercial travellers visited first the greater cities (Warsaw, St. Petersburg, Moscow, Kiew, and Odessa), and then, during a second tour, the less important centres, without, however, referring in any way to the usual intermediaries and commission agents. On arriving at a city, they asked the French Consul for a complete list of well-to-do families, citizens, and officials residing in the place. These were then invited to visit the show rooms, which for that purpose had been temporarily established in a first-class hotel. Indeed, those who were invited arrived in surprising numbers, in the expectation of being able to buy directly from the manufacturer at low prices. Thus, the Consul reports that one commercial traveller succeeded in obtaining within eight days private orders to the value of 25,000 francs, which, at all events, must be regarded as a successful result, considering that it was the first time such a business method was put into practice.

New Fibre in Brazil.

Bd. of Trade J., Dec. 1899, 738.

A correspondent of the *Jornal do Commercio* of Rio de Janeiro draws attention to the fibre of the guaxima, which grows wild everywhere, but is found in largest quantities on the low lands near the sea. It is believed that this fibre would prove an excellent substitute for jute, which is all imported, and when cultivated prove the basis of an important industry.

The threads are long and very strong and will resist the action of water; the fibre being used by fishermen on the coast for their nets, which last for years if soaked in a tincture of aroeira bark.

The process of elaboration of the guaxima fibre does not require long maceration in vessels, as is the case with jute; immersion for a few days in running water being sufficient to loosen the green outer bark with the hands, after which the rods are exposed to the sun in order to dry the woody part; this then contracts and allows the fibres to be easily separated.

A sample was to be sent to England to be spun and woven, and its uses and application thoroughly investigated.

A Graphite Mine.

Eng. and Mining J., Dec. 9, 1899, 694.

One of the finest fissure veins of graphite at present known in the United States is located in the town of Cranston, Rhode Island, near the Providence line. For some years prior to 1892, it was known that graphite could be obtained in certain quantities, and of good quality at this point. In 1892 capitalists became interested, and it was decided to remove the face of the ledge of granite back to the vein itself.

At considerable expense this was done, and thousands of tons of granite and earth, comprising a mass some 60 ft. in height, and running back into the ledge from starting point, a distance of some 50 to 60 ft., by 125 ft. wide, was removed, and the vein of graphite revealed.

The machinery for preparing the product of the mine for market is very complete, and the graphite finds its way to crusher, dryer, pulveriser, bolts, and all prepared at the mine, is put through a bolt, made of silk, 160 meshes to the square inch, and then to the barrelling machine, and is handled by elevating and conveying machinery wherever possible. A part of the product is ground for paint, and is used on all kinds of structural iron work. It is also used in the manufacture of pencils, and is especially valuable for foundry facings. Its chemical analysis gives on the average 52 per cent. of graphitic carbon, traces of oxide of iron, and a little asbestos, the rest being silica.

Some veins of asbestos are found running through parts of it, the thickest being some 2½ ins. thick, but of no great extent. The proportion of graphitic carbon runs from 52 up to 58 per cent.

Will Cordite be Displaced?

Chem. Trade J., Dec. 16, 1899, 400.

There is a feeling all over Europe and the United States at the present time that the nitroglycerin powders must eventually give place to a true guncotton powder. The Germans have long been using ballistite, which contains 40 per cent. of nitroglycerin, but they are now experimenting with a view of using a pure guncotton powder. France has a powder without nitroglycerin, a guncotton compound with some other substance, not nitroglycerin. Spain is using a powder without nitroglycerin. The British Government cordite, with its large percentage of nitroglycerin, has done very well, not on account of the large quantity of nitroglycerin, but because everything connected with it has been so very well done, that is, both the nitroglycerin and the guncotton are well made, and the percentage of vaseline being large, the powder has succeeded better than any other kind with a large quantity of nitroglycerin. Its erosive qualities, however, make short work of the gun using it. Considerable attention has lately been given to the pure guncotton powder made for the United States Naval Service by the California Powder Company. None of this powder has ever detonated or injured a gun, and some remarkable results have been arrived at in obtaining velocities with low pressures equal to cordite. It is stated that velocities, with nearly 3,000 ft. per second, with safe pressure, have been obtained with a 6-in. Vickers-Maxim gun at Sandy Hook, the projectile being long and heavy for the bore. This is rightly regarded as a great achievement, particularly as the powder does not erode the bore to anything like the same extent as cordite. As before stated, this is a pure guncotton powder, and is the only one which has been found successful in large guns in the United States. This powder is the standard for the United States Naval Service, the Dupont nitroglycerin powder having only been experimentally used.

Matches in Mauritius.

Comm. Intelligence, Dec. 23, 1899.

Japan and Sweden have nearly driven English matches from the Mauritius market. In regard to wooden safety matches, there is a reason which might be noticed by British manufacturers. The ordinary safety match is large, and made up in boxes unsuited to the smoker's pocket. The Japanese and Swedish matches are in more convenient sizes. The duty is R. 1·10 levied per gross on boxes containing each not more than 100 matches, and a proportional duty on boxes containing more than 100 matches. If, then, the British match makers were to make small matches put up in boxes containing not more than 100 matches, they might recover the trade.

THENARDITE (SODIUM SULPHATE) IN SPAIN.

Pharm. J., Dec. 16, 1899, 580.

This deposit, although its existence has been known for some time, has only recently been measured and surveyed. It is situated in the salt mines of Castellar, at Villa Rubia de Santiago, Toledo, Spain. The thenardite had been noticed in the old salt workings, which date back many years, but was lost to view in consequence of a falling in of the galleries, and has recently been rediscovered by a further subsidence.

The beds of rock salt are of extraordinary purity, and when ground produce an excellent crystal salt. The deposit is 17 metres thick, more than 2 kilos. long, and of an average width of 500 metres. That is to say, the quantity would be more than 15,000.000 cubic metres.

From a cañon in the mine issues a stream of mineral water, impregnated with sulphate of soda by its passage through the deposit. This stream flows into the river Tagus, and is of sufficient strength and volume to entirely depopulate the river of fish for some distance below that point.

The following is an analysis of the mineral water by the Spanish chemist, D. Fausto Garagaza :—

	Grammes per litre.
Sulphate of soda	106·7000
„ magnesia	0·6336
„ calcium	0·6759
Silica	0·0154
Chloride of sodium	0·2211
Oxide of iron and alumina	0·1619
Total	108·4079

The sulphate of soda contained in this water is obtained by conducting into a reservoir, where the heat of the sun evaporates the liquid, and almost chemically-pure sulphate crystallises out. This is at present consumed by a soap factory at Aranjuez.

The thenardite deposit exists next to the rock salt, and is 10 metres in thickness. There has been measured of it more than 2,000,000 tons, and much remains unmeasured.

The following is an analysis by Garagaza :—

Sulphate of soda	97·049
„ calcium	0·699
„ magnesia	0·566
Chloride of sodium	0·147
Oxide of iron and alumina	0·211
Silica (soluble)	0·014
Insoluble matter and loss	1·314

An analysis recently made of another sample from the deposit showed over 99 per cent. of sulphate.

It is proposed to utilise this immense deposit of practically pure sulphate of soda in the manufacture of carbonate and caustic soda, which should prove commercially very profitable, as coal, wood, and carbonate of lime are all plentiful in the district. The quality of the sulphate is also excellent for glass-making.

THE PAPER TRADE.

Comm. Intelligence, Dec. 2, 1899, 15

Paper prophesies that the American papermaker will be thoroughly master of the situation in England, because (1) he has cheap freights; (2) because he has the raw material; (3) because the English maker has to resort to steam for power; (4) because though labour is cheaper it costs the British more per 100*l.* in the long run; and (5) because English machinery is out of date and inferior to American.

It is true that the American maker has cheap freights to certain ports in this country, but the paper is not, as a rule consumed there, and has to pay the high inland carriage just as the home-made article has. Secondly, the United States maker has *not* got the raw material, but has to depend on a British colony for it to a large extent, and pay more for it than the makers here. Thirdly, water-power is not a *sine qua non* in modern papermaking, in addition to which the development of water-power is very expensive. Fourthly, labour costs much the same in all countries per lb. of paper; and fifthly, to say that English machinery is out of date and inferior to American is to display ignorance of the true state of affairs. America has only been able to place two machines in this country *as an experiment*, with results which do not justify boasting, whereas we have placed, and are placing, machines in every country of the world with the best results. Finally, America has not yet been able to place a ton of newspaper in this country at a profit to the makers or exporters, or with satisfactory results to the consumers.

OIL TRADE OF EGYPT.

Imp. Inst. J., Dec. 1899, 331.

The Belgian Consul at Cairo reports that the imports of hemp, linseed, colza, sesame, cocoanut, and turpentine oils are becoming more important every year. The importation from England amounts to as much as is sent by all other countries together. Of the total, linseed oils form about two-thirds; there are two kinds, namely, boiled oil for painters, and raw and sweet oils used by the natives for alimentary purposes. These two qualities are monopolised by British industry. A boiled oil, coming from Liverpool, is in great favour, costing from 17*s.* to 21*s.* per cwt. f.o.b. Alexandria, owes its popularity to its limpidity and its drying qualities. In edible linseed oils a Liverpool brand is also most appreciated; it is very sweet, although retaining a strong taste of linseed. The prices vary from 16*s.* to 20*s.* f.o.b. Alexandria. Cocoanut oil also comes from the United Kingdom.

NICKEL ORE AND MATTE IN ONTARIO, CANADA.

Chem. Trade J., Dec. 2, 1899, 362.

It is announced that the Ontario Government has passed an Order making it a condition of future patents for copper or nickel land that neither ore nor matte shall be exported from Ontario. The effect of this Order upon the industries of the Province will be far reaching, and may result in the establishment in Ontario of extensive works for the production of nickel to be used in building warships for the British navy. Moreover, this effect will be heightened if our Admiralty accept the offer of the Canadian Government, and acquire the remaining unpatented deposits.

BREWER'S GRAINS IN SOUTH AFRICA.

Comm. Intelligence, Dec. 2, 1899, 10.

Brewers' refuse grain would sell largely at Cape Town, if it could be pressed into briquettes after being mixed with corn meal, oil meal, or some such article of food, and molasses, glucose, or other cheap material of this nature. Samples of this refuse grain have arrived, but it is too light, and on account of its bulk, freight rates would be excessive, and consequently it could not compete in price with other cattle food stuffs.

GLASS PAVING BLOCKS.

Eng. and Mining J., Nov. 25, 1899, 634.

The Garchey glass paving blocks laid down in Lyons France, some months ago are reported to wear very well only a few having become chipped. The blocks have a superficial area of about 64 sq. ins., the face being divided into 16 squares by cross furrows so as to afford better foothold. They are set close together to prevent percolation, and are stated to be more durable than granite, while cleaner than wood blocks or asphalt. A large factory has been erected near Lyons for producing these blocks, as well as plain and ornamental blocks for building purposes.

MANUFACTURING CHEMISTS' ASSOCIATION OF THE UNITED STATES.

Eng. and Mining J., Nov. 25, 1899, 645.

At a recent meeting in New York City the following officers were elected:—President, Nicholas Lennig; vice-presidents, Edward D. Pearce, F. P. Hazard; executive committee, C. A. Grasselli, chairman; A. M. Purves, A. P.

Howard, W. H. Nichols; secretary and treasurer, C. Lynde Cochrane, of Boston. Representatives of the following firms were present.—The Ammonia Company, Cochrane Chemical Company, Columbia Chemical Works, Fairfield Chemical Company, Grasselli Chemical Company, Highlands Chemical Company, Martin Kalbfleisch Chemical Company, Lazaretto Guano Company, W. H. Matheson and Company, Ltd., Merrimac Chemical Company, James L. Morgan and Company, Nicholas Chemical Company, Passaic Chemical Company, Pennsylvania Salt Manufacturing Company, T. P. Shepards and Company, Solvay Process Company.

Japanese Chemical Industry.

Comm. Intelligence, Dec. 2, 1899, 11.

There is a beginning of a large scale chemical industry near Osaka, where the alkali works of the Yuso Kwaisha and sulphuric acid works of the Nippon Yuso Kwaisha are situated. The Yuso Kwaisha was started six years ago by English engineers, who fitted it up on the most approved principles, but is now entirely under Japanese management. At the works of the Nippon Yuso Kwaisha sulphuric acid is concentrated in Kioto porcelain vessels in terraced succession. Platinum vessels gave an acid of less than 60° B. strength. Wakayama and Okayama pyrites, containing from 47 to 50 per cent. of sulphur, is used. The sulphuric acid, packed in earthenware carboys, has been exported in small quantities as far as Bombay. There are also numerous soap and perfumery factories in Osaka and a pharmaceutical factory in Tokio, but all produce low quality goods at present. Iodine is also manufactured from seaweed, but in a very small way.

Hamburg Malt.

Comm. Intelligence, Nov. 25, 1899, 17.

In 1897, the export of malt from Hamburg exceeded that of the preceding year by almost 33⅓ per cent. The decrease of 2,700 tons in the year 1898 is equal to the decrease of import of the article into Brazil, which may be due to the present financial troubles of that country.

The export of malt from Hamburg has, during the last six years, increased steadily, as follows:—

Year.	Weight.	Value.
	Tons.	£
1893	9,770	157,500
1894	14,099	214,500
1895	17,378	224,000
1896	20,496	291,500
1897	26,851	396,500
1898	24,180	356,300

The price has decreased from 30 marks per double centner (220·46 pounds) in 1897 to 29 marks per double centner in 1898.

This export has developed through the growth of the brewing industry in Central and South America. The decrease in the export of beer and the increase in the export of malt appear to be concomitant.

The greatest market for Hamburg's malt for the last decade has been Brazil, although the decrease this year has been about 2,500 tons. The export of malt to Japan has greatly increased during the past year. There are also great quantities exported to Cape Colony, Venezuela, the Philippines, and Cuba. The formerly flourishing export to Uruguay has been fluctuating. The total export in 1898 reached 14,450 tons, against 17,060 tons in 1897.

Japan: Openings for Trade.

Imp. Inst. J., Dec. 1899, 327.

According to Mr. Hiraga, President of the Commercial Museum at Osaka, the goods chiefly in demand in Japan are: Iron, wrought and cast; steel in all its forms; nails, needles, and wire; galvanised iron; aluminium and its manufactures; celluloid and its manufactures; leather manufactures; bichromate tannin; paraffin and wax; and india-rubber, crude, refined, and manufactured.

Tests of Fire-resisting Materials.

Ironmonger, Dec. 2, 1899, 374.

The British Fire-prevention Committee was incorporated early this year to use its influence towards minimising the possibilities and dangers of fire, and to undertake independent investigations and tests of materials, methods, and appliances.

With a view to a proper prosecution of the latter aim, a well-equipped testing-station has been erected at 35, North Bank, Regent's Park, N.W. Here are established huts or testing chambers and a gas-manufacturing plant, which consists of a generator with small vertical boiler, an explosion-box, and a line of mains with branches. Each hut is provided with two mixing-chambers of firebrick, each measuring 10 ft. by 3 ft., where the gas and air mix before combustion. Only four huts have been erected, but, as occasion requires, the number will be increased. The chambers are large enough to accommodate a roof or floor measuring 10 ft. by 10 ft., thus subjecting a superficial area of 100 sq. ft. to fire-test. Records are taken as far as possible automatically and by photography. The temperature of the testing-chambers is recorded by Roberts-Austen's electrical pyrometers. In reports of tests the bare facts and figures are given, and comments of any sort are carefully avoided.

Tests with Doors.

Oak and teak doors did not show under actual trial any marked superiority over the commoner woods, deal and pitch pine. A 2-in. solid-framed teak door collapsed within 65 minutes. On another occasion two doors—of oak and teak respectively—both 2-in. framed doors with 2-in. solid panels, became consumed in two minutes under the hour.

Fireproof Floors and Safe Tests.

There was also a test of a concrete floor and of an iron safe. The specification of the floor come under the London County Council requirements as "fireproof." It was 5 ins. thick, and was composed of breeze-concrete, with steel girders. The duration of this test was expected to be two and a half hours, and a temperature of 2,000° was to be attained. In an hour and a half, however, when less than 1,400° was recorded, the concrete gave way and fell into the body of the furnace.

The safe was by a good English maker, and was of a construction usually sold as "fireproof." Outside dimensions were 25 ins. by 19 ins. by 19 ins., and internal measurements were 19½ ins. by 13½ by 15 ins. In the safe were deposited various papers. When the fire was extinguished and water applied, it had been subjected for an hour and a half to heat which at its maximum reached to some degrees below 1,400°. After it had been opened, it was evident that the low test to which it had been subjected was in excess of its fire-resisting properties. The papers which had been placed within were wholly destroyed. The fire-resisting composition in the walls had been baked and charred. The sides had bulged somewhat by the internal pressure of the steam generated in the walls, but had not burst. On the other hand, sheets of wired glass made by Pilkingtons, and three casements glazed by the Luxfer Prism Syndicate behaved more satisfactorily. The former, placed in two skylights, stood for 30 minutes, before the expiry of which time the temperature reached 1,500°. The glass began to crack one minute after the start. In 15 minutes, after the application of water, it began to bulge, but except for the cracks it remained intact and no fire was able to pass through it. The Luxfer prism test was also successful. Three casements were operated on, and, although a temperature of 1,600° was reached, it was 35 minutes before the first fell inwards.

In their tests the Committee seek to gather reliable data regarding the heat-resisting properties of the various materials and devices used in buildings. Their apparatus is at the service of any manufacturer who desires to submit a speciality to the tests. Certain fees to meet expenses are charged.

BELGIAN ARTIFICIAL STONE.

U.S. Cons. Reps., Dec. 1899, 655.

An artificial stone from Belgium has recently been introduced into the French market, which is said to have four times the force of resistance of French freestone and which has nearly all of the properties of Cobestang granite. It has been tried in the Malines arsenal and is found to be insensible to the action of cold, absorbs only 6 to 7 per cent. of water, even after a long dry spell, and cannot be crushed under a pressure of 40 kilos. (88·184 pounds) to the square centimetre. This artificial stone is manufactured at Uccles, near Brussels, in the following manner:—80 parts of extremely clean and dry coarse sand are mixed with 20 parts of hydraulic lime reduced to a fine, dry dust; this mixture is put into an iron box, which is plunged into a boiler of water, and this is hermetically closed. During 72 hours, the cooking goes on under a pressure of 6 atmospheres, the temperature being maintained at 165°. At the end of this time, the iron box contains a perfect homogeneous mass of stone, which rapidly hardens upon exposure to the air. The most varied colours are given to this stone, and its manufacture costs only 2 cents per cubic foot.

IRON RESOURCES OF SPAIN.

Comm. Intelligence, Dec. 9, 1899, 21.

The iron ore resources of Spain—a question of considerable importance to the British iron and steel industry—is the subject of a statistical examination in the *Iron and Coal Trades Review*. Of hematite ore, now solely exported to this country, it is computed that the supply still left in the Spanish deposits is 150,670,000 tons, and that the greater part of this will be exhausted long before 1920. But in addition to the hematite ore, there is a very much larger available quantity of phosphoric ore, estimated at 875,000,000 tons. This is less valuable than hematite, because of the greater cost of eliminating the foreign admixture. It is assumed that as the supply of the latter becomes reduced the use of the phosphoric ore will be increased. In the absence of new discoveries of readily accessible hematite, it is believed that the British smelting works, which now draw about 5,000,000 tons of hematite from Spain, will have been prepared for the utilisation of phosphoric ore. Of this there is evidently an abundant reserve in Spain, in addition to the large quantity of it still available in our own country and in Sweden.

CANADIAN CHEMICAL TRADE.

Chem. and Druggist, Dec. 9, 1899, 933.

The High Commissioner for Canada, in a report on the trade and commerce of Canada for September, states that drugs and medicines were imported to the value of 133,449 dols. against 129,509 dols. in September 1898. For the three months ended September 30 the imports of these were 404,108 dols. against 448,642 dols. in the corresponding three months of last year. The quantities of soap imported in October was 40,013 dols. against 27,472 dols., and in the three months ended September 30, 1899, 111,071 dols. against 94,990 dols. in the corresponding period of 1898. These were dutiable goods. In the free list dyes, chemicals, &c., figure among the imports to the extent of 180,741 dols., against 157,618 dols. in September, 1898, and 454,486 dols. in the three months ending with September, against 628,977 dols. for the corresponding period of 1898. Alkali to the value of 42,355 dols. (41,613 cwt.) was exported from Great Britain to Canada for the three months ending September, against 53,654 dols. (41,173 cwt.) for the same period of 1898, thus showing a decrease in value and an increase in quantity.

ESSENTIAL OILS FROM SICILY AND CALABRIA, EXPORTS OF.

Schimmel's Semi-Annual Report. Leipsic, Oct. 1899, 28.

The essential oil market in Italy, during the past half year, has been quiescent, the only marked fluctuation being an advance in the price of orange oil. The total export of oils from Messina during the first eight months of the present year amount to 460½ tons, against 391 tons in the corresponding period of 1898, and 544½ tons in 1897. This increase in exports over the preceding year is due to the demand for the oils in the United States, indicating that the large reserve stock, accumulated by speculators in America previous to the enforcement of the new Customs Tariff in 1897, has now become exhausted.—J. O. B.

EUCALYPTUS OIL IN ALGERIA AND PORTUGAL.

Schimmel's Semi-Annual Report, Oct. 1899, 31.

Algerian eucalyptus oil has been scarce for many months, due to the exhaustion of the supply of leaves near the fixed distilling plant in the towns. It is now necessary to have movable stills, and, to obtain material for these, to go further into the interior. Consequently, the owners of these stills are only willing to work them if they can sell large quantities of the oil, in advance, at a fair price.

The *Portuguese* plantations, in which *E. globulus* is specially cultivated, have continued to develop. The oil produced has shown a constant normal amount of cineol. The output during 1898 amounted to 12 tons. The leaves of young trees are found to yield considerably less oil than the narrow phyllodes of the older trees. There is now no question of over-production of this variety of eucalyptus oil; a possible scarcity is anticipated.—J. O. B.

ORANGE FLOWER (NEROLI) OIL.

Schimmel's Semi-Annual Report, Leipsic, Oct. 1899, 41—43.

THE crop of orange flowers has been normal this year, and the oil derived from it above the average. From observations conducted throughout the harvest, extending from April 24th to May 15th, the yield of oil was found to be lowest at the commencement of the season, from the 24th to 30th of April, *viz.*, 0·8 per mille of flowers, and highest towards the end, on May the 13th, when 1·23 per mille was obtained. The figures were obtained on the basis of the distillation of 1 kilo. of flowers with 1 kilo. of water, without redistillation of the water, as is generally done.
—J. O. B.

PEPPERMINT OIL, AMERICAN.

Schimmel's Semi-Annual Report, Oct. 1899, 44—46.

Wayne County Oil.—Over-production of former years has caused such a depreciation in the price of oil that the cultivation of the plant has undergone a great decrease. The area under cultivation in 1890 amounted to 3,340 acres; in 1899 but 300 acres were planted with peppermint, the attention of farmers being now directed to the raising of sugar-beet. The whole of the peppermint now grown is the so-called black, or English variety. A few farmers continue to grow a small plot of the plant for the sake of the root, which will be available for propagation should the price of the oil be sufficiently remunerative.

Some 10,000 to 12,000 lb. of oil still remain on hand, but none of this can be had under 1 dol. per lb. Distillation of the oil will not be resumed until 1·25 dol. per lb. is obtainable; from 1·75 dol. to 2 dols. is considered to be a good price, and until that figure is reached the output will not equal that of former years. One distillery at Lockville in 1894 produced between 2,300 lb.; this year the output there will not exceed 300 lb.

Michigan Peppermint Oil.—In the early days of the industry, the so-called uplands were the chief sites of the mint crop, but some 10 or 15 years ago it was discovered that the plants flourished much better in the drained marshes. In Wayne County a yield of 25 lb. of oil per acre for the first year and 15 lb. for the second was regarded as a fair average crop. On good Michigan marsh land 60 lb. has been obtained per acre in the first year, and the second and third years have given 40 lb. each, even the fourth year giving a fair crop. It is stated that on good marsh land, oil can be produced with profit at 50 cents per lb. During the first year a considerable amount of labour has to be expended on the crop, but in the second and third year this is confined to occasional weeding, which is done by mechanical means. The yield of this year's distillation in Michigan is likely to be about three-fifths of the average of 1897 and 1898; the total output being 180,000 lb., which, with stock now in hand, brings the total available for this year to 230,060 lb. The total export of Michigan oil in 1897 was 162,492 lb., valued at 257,484 dols. Of this quantity Germany took 65,040 lb.; England, 63,731 lb.; and France, 21,734 lb. Practically the whole was exported from New York. In 1898 the amount exported fell to 145,375 lb.—J. O. B.

Solar Oil, and Lamps for Burning it.

Petroleum Industrial and Technical Review, Dec. 9, 1899, 658 *and* 670.

The Russian journal *Caspian* urges that the Russian Government should take special steps to facilitate the use of solar oil for illuminating purposes The duty on this oil has been reduced to 50 copecks per pood, against light oil, which is charged at 60 copecks. But this is not sufficient to allow the refineries to produce solar oil profitably. In its opinion, solar oil should be entirely free from excise duty. The high flash point of solar oil should make it suitable for public buildings, railway carriages, &c. But in spite of the numerous attempts to design lamps for burning it, the difficulties have not yet been overcome. Makaroff, of St. Petersburg, has constructed a large number of burners for burning heavy oils, while Siamashko has also constructed a special lamp for this purpose, in which the oil is preheated. The principle usually adopted in designing a burner for heavy oils is that of having an auxiliary wick which assists in drawing up the necessary oil into the main wick, but this is regarded as a great disadvantage. Solar oil having a high boiling point, and being apt to decompose at a high temperature and form coke, which causes a charring of the wick, burners entirely different from those in which kerosene is used must be adopted for it. Whereas in the case of kerosene, the oil rises through the wick, the solar oil, having a higher viscosity, cannot do so, and therefore the system of burning the oil should be by means of a reservoir placed above the burner. The lamp should be so arranged that the oil reservoir is placed above the burner, so that the oil descends to the wick.

Commenting on the above the *Petroleum Industrial and Technical News* says:—If a satisfactory burner could be devised for burning heavy oils, great economy would be effected for everyone engaged in the production and refining of Baku oil. For the time being, generally from 28 to 30 per cent. of burning oil only is received from the crude product, the remainder being disposed of as liquid fuel. If, however, a lamp could be introduced for the use of these oils, at least 50 per cent. of illuminating oil could be obtained from the crude.

Coke from By-Product Ovens in the United States.

Eng. and Mining J., Dec. 2, 1899, 661.

The Boston and Maine Railroad Company has arranged to use coke in a large number of its locomotives, which have heretofore been using bituminous coal (see this Journal, Sept. 1899, 878). It was at first thought that water-grates, like those used with anthracite, would be necessary, owing to the intense heat of combustion obtained with coke under a strong draught; but experiment has shown that good results can be obtained with the grates used for coal, the only change made being to run a steam pipe across the end of the ash pan, permitting steam to escape in jets from $\frac{1}{4}$-in. holes in the pipe. The cooling effect of the steam is sufficient to prevent failure of the grate bars.

Labour in the German Iron Industry.

Comm. Intelligence, Dec. 16, 1899, 8.

The German iron industry has been greatly affected during the past year by an influence which is likely to be more or less permanent, and thus to react on German competition in outside markets. There has been an absolute scarcity of labour, which has compelled manufacturers to offer considerably higher wages. It is likely that these higher rates will be maintained in the future. Great efforts have been made to induce agricultural labour to migrate to the manufacturing centres during the past year.

BOARD OF TRADE RETURNS.

Summary of Imports.

Articles.	Month ending 30th November.	
	1898.	1899.
	£	£
Metals	1,768,774	2,254,247
Chemicals and dyestuffs	394,603	418,903
Oils	609,750	877,679
Raw materials for non-textile industries.	4,127,950	5,178,602
Total value of all imports	42,068,814	44,244,811

Summary of Exports.

Articles.	Month ending 30th November.	
	1898.	1899.
	£	£
Metals (other than machinery)	2,760,470	4,013,752
Chemicals and medicines	690,973	780,713
Miscellaneous articles	2,937,739	3,166,354
Total value of all exports	19,820,207	24,571,940

Imports of Metals for Month ending 30th November.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Copper:—				
Ore ………… Tons	8,569	16,145	86,515	89,146
Regulus ……… „	5,118	6,014	129,876	157,601
Unwrought ….. „	5,991	4.113	327,913	302,002
Iron:—				
Pig and puddled „	25,581	11,162	81,844	46,925
Ore ………… „	357,678	511.695	258,828	403,297
Bolt, bar, &c. … „	5,953	8,289	46.647	69,102
Steel, unwrought.. „	1,882	3,802	16,272	24,853
Lead, pig and sheet „	15,831	15,186	212,314	251,862
Pyrites ……… „	52,548	64,019	91,369	98,919
Quicksilver ……. Lb.	8,450	65,000	816	6,966
Silver ore……. Value £	..	..	101,409	68,099
Tin …………… Cwt.	25,827	40,300	102,972	264,759
Zinc…………… Tons	5,561	5,013	112,453	115,568
Other articles … Value £	..	..	199,546	355,148
Total value………	..	..	1,768,774	2,254,247

Imports of Chemicals and Dyestuffs for Month ending 30th November.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali………… Cwt.	26,425	24,968	11,512	14.203
Bark (Tanners', &c.) „	20.355	30,433	7,280	12,624
Borax ………… „	305	9,645	260	4,709
Brimstone ……. „	33,851	41,593	8,658	9,377
Chemicals…… Value £	..	..	132,060	110,848
Cochineal ……… Cwt.	550	526	3.104	2,522
Cutch and gambier Tons	1,864	1,299	27,356	23,810
Dyes:—				
Alizarin…….Value £	..	..	21,485	15,530
Anilin and other „	..	..	46,679	51,332
Indigo ………… Cwt.	635	1.322	9,633	19,270
Nitrate of potash.. „	21,642	22.824	18,966	19,033
Valonia ………. Tons	1,507	2,762	16,508	36,314
Other articles … Value £	..	..	91,102	99,331
Total value………	..	..	394,603	418,903

IMPORTS OF OILS FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Cocoa-nut....... Cwt.	25,368	50,625	28,972	58,355
Olive............ Tuns	342	1,143	11,924	41,994
Palm .... Cwt.	82,113	64,437	90,177	71,302
Petroleum ...... Gall.	15,143,472	18,789,237	276,343	410,312
Seed............ Tons	3,342	3,586	62,869	66,474
Train, &c. ...... Tuns	2,269	2,741	35,644	46,167
Turpentine ..... Cwt.	12,012	60,919	14,438	104,276
Other articles Value £	..	..	89,383	76,799
Total value	..	..	609,750	875,679

IMPORTS OF RAW MATERIAL FOR NON-TEXTILE INDUSTRIES FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Bark, Peruvian .. Cwt.	1,184	1,337	2,848	3,656
Bristles.......... Lb.	349,260	554,028	38,274	75,478
Caoutchouc ...... Cwt.	47,619	38,756	657,777	562,931
Gum :—				
Arabic .... „	6,326	5,636	13,837	13,637
Lac, &c. .... „	6,231	9,226	21,984	30,742
Gutta-percha .... „	4,577	8,101	52,201	108,028
Hides, raw :—				
Dry............. „	33,409	32,332	82,448	87,020
Wet .... „	54,411	91,063	116,467	197,230
Ivory .... „	879	842	35,275	30,591
Manure :—				
Guano .... Tons	2,795	1,001	16,832	6,085
Bones.......... „	5,262	6,951	21,742	34,514
Nitrate of soda... „	8,369	7,906	65,162	57,205
Phosphate of lime „	18,301	41,015	25,873	71,512
Paraffin.......... Cwt.	74,674	95,170	64,121	98,564
Linen rags .... Tons	1,468	1,892	14,061	14,299
Esparto .... „	10,484	19,919	42,478	83,829
Pulp of wood :—				
Chemical ...... „	19,695	16,652	131,264	133,719
Mechanical .... „	20,439	13,614	55,925	32,014
Rosin............ Cwt.	63,878	149,397	13,732	35,290
Tallow and stearin „	139,585	249,885	152,260	300,636
Tar ....Barrels	4,232	2,420	3,510	1,901
Wood :—				
Hewn.......... Loads	169,043	197,920	339,023	425,843
Sawn .... „	428,853	548,251	983,299	1,320,104
Staves .... „	8,012	12,876	44,789	53,389
Mahogany ..... Tons	7,298	8,083	63,133	74,982
Other articles....Value £	..	..	1,078,635	1,325,403
Total value	..	..	4,127,950	5,178,602

Besides the above, drugs to the value of 114,960*l*. were imported, as against 75,962*l*. in November 1898.

EXPORTS OF DRUGS AND CHEMICALS FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Alkali .... Cwt.	331,381	404,661	87,974	103,185
Bleaching materials „	111,116	140,327	30,167	34,355
Chemical manures Tons	30,726	35,066	176,059	203,211
Copper sulphate .. „	247	876	4,138	20,811
Medicines....... Value £	..	..	104,062	106,514
Other articles... „	..	..	288,573	312,637
Total value	..	..	690,973	780,713

EXPORTS OF METALS (OTHER THAN MACHINERY) FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Brass............. Cwt.	9,827	9,702	42,877	50,689
Copper :—				
Unwrought.... „	61,047	38,168	170,538	155,197
Wrought ...... „	25,200	20,797	81,782	92,422
Mixed metal... „	19,058	11,720	47,159	39,278
Cutlery ....Value £ Hardware .... „	..	..	184,813	202,537
Implements...... „	..	..	114,562	135,473
Iron and Steel ... Tons	252,537	345,638	1,854,937	2,792,488
Lead.............. „	2,515	2,685	36,868	46,434
Plated wares... Value £	..	..	48,672	45,528
Telegraph wires.. „	..	..	39,837	260,239
Tin .... Cwt.	10,243	11,212	42,371	80,182
Zinc.......... . „	12,198	12,915	12,278	13,824
Other articles...Value £	..	..	83,776	99,461
Total value	..	..	2,760,470	4,013,752

EXPORTS OF MISCELLANEOUS ARTICLES FOR MONTH ENDING 30TH NOVEMBER.

Articles.	Quantities.		Value.	
	1898.	1899.	1898.	1899.
			£	£
Gunpowder..... Lb.	608,600	685,600	15,878	16,052
Military stores.. Value £	..	..	142,742	162,882
Candles......... Lb.	2,899,900	1,802,500	35,578	29,952
Caoutchouc..... Value £	..	..	112,447	124,742
Cement......... Tons	25,008	38,074	48,053	72,686
Products of coal. Value £	..	..	121,957	131,918
Earthenware ... „	..	..	151,327	176,648
Stoneware ...... „	..	..	14,028	15,466
Glass :—				
Plate .... Sq. Ft.	134,181	134,747	8,120	7,962
Flint .... Cwt.	7,871	7,650	13,425	19,870
Bottles .... „	75.757	66,802	35,252	32,147
Other kinds ... „	26.798	18,841	24,369	18,516
Leather :—				
Unwrought .... „	13,279	13,061	116,976	130,804
Wrought......Value £	..	..	40,348	41.388
Seed oil .... Tons	3,679	4,293	65,935	90,881
Floorcloth.......Sq. Yds.	1,733,100	2,032,500	76,188	93,783
Painters' materials Val. £	..	..	154,128	156,364
Paper............. Cwt.	75,902	82,601	121,133	119,536
Rags.............. Tons	5,052	7.435	26,444	40,954
Soap .... Cwt.	62,164	81,733	68,268	87,446
Total value	..	..	2,937,739	3,166,354

Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

23,158. J. McNeil and C. McNeil. *See* Class XVI.

23,287. The British Thomson-Houston Company, Ltd.—From J. W. Howell, United States. Improvements in producing high vacua. Complete Specification. Nov. 22.

23,404. P. Naef. An improved method of and apparatus for treating liquids. Filed Nov. 23. Date applied for April 26, 1899, being date of application in United States.

23,419. H. Platz. Improved manufacture of bottles or receptacles for containing compressed gases and the like. Nov. 23.

23,467. J. Lyle. An improved construction and arrangement of retort for heating or distilling finely divided substances. Nov. 24.

23,598. J. McNeil and C. McNeil. *See* Class XVI.

23,681. J. Foster. Improvements in and relating to concentrating apparatus. Nov. 28.

23,756. H. H. Lake.—From A. J. Perkins and F. C. Weber, United States. Improvements in apparatus for sterilising, drying, and cooling air. Complete Specification. Nov. 28.

23,765. E. Gobbe. Improvements in apparatus for use in compressing air and gas. Nov. 28.

23,766. E. Gobbe. Improvements in kilns, blast furnaces, melting furnaces, and the like. Nov. 28.

23,828. J. Y. Johnson.—From The Compagnie Générale pour la Conservation des Liquides, France. Improvements in and apparatus for sterilising liquids. Complete Specification.

23,903. H. Buderus. Improvements in apparatus for supplying furnaces with pulverulent fuel. Nov. 30.

23,948. C. Dansard. Improvements in drying apparatus. Complete Specification. Dec. 1.

24,022. S. Couper. Improvements in apparatus applicable for use as a condenser, feed heater, or evaporator. Complete Specification. Dec. 2.

24,024. P. Kestner. Improvements in apparatus for concentrating, distilling, and of elevating liquids. Dec. 2.

24,306. H. H. Lake.—From The Firm of N. O. Fu Alessandro, Italy. Improvements in evaporating apparatus. Complete Specification. Dec. 6.

24,313. H. Holden and R. G. Brooke. Improvements in apparatus suitable for heating or evaporating water or other liquid and as a condenser. Dec. 6.

24,365. C. S. Meacham. Apparatus for drying hops and other like materials. Dec. 7.

24,487. M. L. Dunham. Improvements in evaporating apparatus. Filed Dec. 9. Date applied for May 10, 1899, being date of application in United States.

24,847. O. Guttmann. Improvement in bodies which are used in reaction and the like apparatus for facilitating the contact between liquids and gases. Complete Specification. Dec. 14.

COMPLETE SPECIFICATIONS ACCEPTED.*

1898.

26,199. W. P. Thompson. Surface condensers. Nov. 29.

26,767. F. C. Thrupp. Apparatus for refrigerating and liquefying air and other gases. Nov. 29.

1899.

2938. J. Ward. Kiln ovens or arrangements for drying stone and similar material. Nov. 29.

3038. H. Vuylsteke. Apparatus for filtering beers and other liquids. Dec. 20.

20,850. A. Smith, F. Smith, and A. S. Muir. Certain new and useful apparatus and process for filtration purposes. Nov. 22.

21,160. A. J. Boult.—From C. Krausse, Germany. Refrigerating apparatus. Nov. 29.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

23,073. J. W. Bailey and J. Clapham. Improved means for use in the purification of acetylene gas. Nov. 20.

23,085. A. Schenk. Improvements in the manufacture of coke, charcoal, and the like, and in apparatus therefor. Complete Specification. Nov. 20.

23,106. J. G. L. Bormann. Process for increasing the illuminating power of incandescent gas and other lamps. Complete Specification. Nov. 20.

23,149. J. W. B. Wright and E. A. Jeffreys. Improvements relating to the generation of acetylene gas. Nov. 21.

23,179. T. G. Turner. Improvements in gas apparatus and more particularly means for generating acetylene gas. Complete Specification. Nov. 21.

23,203. H. H. Lake.—From Universal Fuel Company, United States. Improvements in the manufacture of coke. Complete Specification. Nov. 21.

23,309. G. G. Smith. Improvements in acetylene gas generators. Complete Specification. Nov. 22.

23,415. P. Naef. An improved method of and apparatus for treating solid materials applicable to the manufacture of gas coke and to other purposes. Filed Nov. 23. Date applied for April 26, 1899, being date of application in United States.

23,417. J. Wagner. Improved manufacture of mantles for incandescence gas burners. Nov. 23.

23,418. J. Wagner. Improved manufacture of mantles for incandescence burners with compressed or acetylene gas supply. Nov. 23.

23,432. A. L. Kieny. Improvements in generators for the production of acetylene gas. Nov. 24.

23,489. J. F. P. Ackermann. Improvements in and relating to acetylene gas generating apparatus. Nov. 24.

23,572. H. H. Boehndel. Improvements in or relating to gas for illuminating and heating purposes. Nov. 25.

23,625. T. J. Perry and E. J. Perry. Improvements relating to acetylene lamps and generators. Nov. 27.

23,724. A. J. Boult. — From C. De Haupt, Belgium. Improved process and apparatus for gasifying petroleum and other hydrocarbons. Complete Specification. Nov. 28.

23,758. P. O. Petterson. Improvements in the method of producing acetylene or similar gas and in apparatus therefor. Complete Specification. Nov. 28.

23,797. Bon-Accord Acetylene Gas Company, B. R. Chicken, and A. G. Smith. Improved acetylene gas generator. Nov. 29.

23,858. G. Schumacher. Process of making naphtha, shale spirit, petrol spirit, &c. inflammable. Nov. 30.

23,874. F. L. Toby and O. S. Borch. A process to manufacture mixtures of carbide of calcium which are free from any danger of explosion in generating gas. Nov. 30.

23,915. J. W. B. Wright and W. Randle. Improvements in acetyle generators. Nov. 30.

23,918. L. de Somzée. Improvements in the manufacture of electrically conductive incandescent filaments and the like. Nov. 30.

23,937. A. E. Adolfsson. Improvements in acetylene gas generating apparatus. Complete Specification. Dec. 1.

23,978. H. B. Helbing and F. W. Passmore. Improvements in and relating to the solidification of liquid mineral oils. Dec. 1.

23,979. H. B. Helbing and F. W. Passmore. Improvements in and relating to the solidification of liquid mineral oils. Dec. 1.

23,988. H. H. Leigh.—From J. W. Carey, Queensland. Means for regulating the supply of water to acetylene gas generators. Complete Specification. Dec. 1.

24,055. E. Springborn. Improvements relating to the manufacture of artificial fuel. Dec. 2.

24,056. G. Zschocke. Improvements in gas scrubbers. Complete Specification. Dec. 2.

24,060. W. H. Drake and R. K. Pelton. Improvements in acetylene gas burners. Complete Specification. Dec. 2.

24,203. M. Posno. Improved device applicable to lighting and heating apparatus for generating gas from gasoline and other inflammable liquids. Complete Specification. Dec. 5.

24,265. R. H. Sunderland, F. Sunderland, and G. Marshall. Improvements in acetylene gas generators. Dec. 6.

24,328. A. J. Boult.—From A. Longuemare, France. Improvements in or relating to carburettors. Complete Specification. Dec. 6.

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* *See* Note (*) on previous page.

24,360. J. St. Leger McGinn. Improvements in gas apparatus. Complete Specification. Dec. 7.

24,364. A. Rouma. Improvements in and connected with apparatus for generating acetylene gas. Complete Specification. Dec. 7.

24,383. S. Chandler, jun., J. Chandler, and Kirkham, Hulett, and Chandler. Improvements in apparatus for washing and scrubbing gas. Dec. 7.

24,406. W. Williams. Improvements in incandescent gas burners. Dec. 8.

24,423. J. Jackson. Improvements in and relating to incandescent gas burners. Dec. 8.

24,502. R. Thomson. Improvements in gas producers. Dec. 9.

24,518. A. M. Plaisetty. Improved process for manufacturing incandescent gas mantles. Dec. 9.

24,796. A. Westrop. Improvements in or relating to apparatus for the generation of acetylene gas. Dec. 13.

24,834. L. Stauffert. Generator for the manufacture of acetylene gas, the arrangement of which allows the development of the gas to take place gradually in measured quantities. Dec. 14.

25,009. A. J. Boult.—From A. Perrier, France. Improved apparatus for the production of gas. Dec. 16.

Complete Specifications Accepted.

1898.

24,501. W. Ellen. Acetylene generators. Nov. 29.

25,297. P. Bucher. Apparatus for generating acetylene gas. Dec. 6.

26,254. W. H. A. Sieverts. Mantles and the like for incandescence gas lighting. Dec. 20.

26,488. J. Wilson. Manufacture of incandescent gas burners. Dec. 6.

26,628. J. S. Goodwin. Acetylene generating apparatus. Dec. 20.

26,767. E. C. Thrupp. *See* Class I.

27,205. J. H. H. Duncan. Improvements in and relating to incandescence burners and mantle supports. Nov. 29.

1899.

2318. W. Irvin and J. P. Leather. *See* Class III.

2392. J. Schneeweis. Acetylene generators. Dec. 6.

3970. G. Detsinyi. Method of heating, and process of manufacturing a suitable preparation therefor. Dec. 20.

4054. A. J. Boult.—From M. de Lasserve, France. Acetylene gas generators. Dec. 20.

4223. H. Berger. Apparatus for generating acetylene gas. Dec. 6.

12,485. H. Teichmann. Process for obtaining cyanogen combinations from coal gases. Nov. 29.

13,674. P. G. de Schodt. Apparatus for use in incandescent gas lighting and heating. Dec. 20.

17,343. A. Däuber. Apparatus for making acetylene gas. Dec. 6.

17,406. F. Matthews. Acetylene gas machines. Nov. 29.

17,780. K. Kubierschky. Process for separating gases and vapours from mixtures. Dec. 6.

18,750. W. L. Voelker and the Voelker Incandescent Mantle, Ltd. Burners for gas lighting by incandescence. Dec. 6.

20,354. J. Lorens. Apparatus for generating acetylene. Nov. 29.

20,423. A. Murinick. Incandescence gas burner. Dec. 20.

20,792. W. Irwin. Apparatus for carburetting or enriching gas. Dec. 13.

21,035. C. Kellner. Manufacture of acetylene. Nov. 29.

21,333. E. Edwards.—From T. Drescher, Germany. *See* Class VII.

21,558. A. J. Boult.—From G. Skaruppe, Germany. Apparatus for igniting illuminating gas at burners. Dec. 6.

22,147. J. Craveri. *See* Class XII.

III.—DESTRUCTIVE DISTILLATION, AND TAR PRODUCTS, Etc.

Applications.

23,252. J. D. Campbell and W. H. Yates. Improvements in and connected with the distillation of organic substances. Nov. 22.

23,524. E. A. Le Sueur. Improvements in process and apparatus for condensing liquids from air. Nov. 25.

24,905. W. F. Sutherst. Production of phenols from tar. Dec. 15.

Complete Specifications Accepted.

1899.

210. S. Holman. Means for securing the lids of gas retorts; applicable also for securing other lids, flaps, doors, and the like. Dec. 13.

2,318. W. Irvin and J. P. Leather. New method of extracting naphthalene from coal-gas. Dec. 20.

19,743. F. Schmidt. Dry distillation of wood and kindred materials. Nov. 29.

IV.—COLOURING MATTERS and DYES.

Applications.

23,122. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of indigo in a form readily soluble in the vat. Nov. 20.

23,123. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Improvements in the manufacture and production of indigo-leuco compounds or other indigo products, and of materials for use therein. Nov. 20.

23,396. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. The manufacture and production of indigo-white compounds. Nov. 23.

23,420. F. Ullmann and F. Kehrmann. Manufacture of azonium dyestuffs. Nov. 23.

23,593. R. J. Urquhart.—From The Chemische Fabriken vormals Weiler-ter-Meer, Germany. Improvements in the manufacture of blue-green dyestuffs of the triphenylmethane series. Complete Specification. Nov. 27.

23,637. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new anthraquinone dyestuffs. Nov. 27.

23,657. R. B. Ransford.—From L. Cassella and Co., Germany. The production of derivatives of indazol, and of dyestuffs therefrom. Nov. 27.

23,827. G. B. Ellis.—From La Société Chimique des Usines du Rhône, anciennement G. P. Monnet et Cartier, France. Improvements in the manufacture of hydroxyaldehydes. Nov. 29.

23,891. V. Rollet. A process for the preparation of concentrated solutions of anhydro orthosulphamide-benzoic acid and its salts. Nov. 30.

23,968. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new anthraquinone dyestuffs. Dec. 1.

24,296. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of new azo dyestuffs for cotton. Dec. 6.

24,638. C. Wülfing. Improvements in or connected with the manufacture of azo-dyes and intermediate products from certain coal-tar products. Dec. 11.

24,765. W. H. Claus, A. Rèe, and L. Marchlewski. Improvements in the manufacture of black colouring matters. Dec. 13.

24,938. H. H. Lake.—From The Firm of K. Oehler, Germany. Improvements in and relating to the manufacture of colouring matters. Dec. 15.

24,953. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of phthalein dyestuffs. Dec. 15.

24,[illegible]. O. Imray. From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of blue mordant dyestuffs of the anthraquinone series. Dec. 15.

24,[illegible]. I. Levinstein and Levinstein, Ltd. The manufacture or production of azo colouring matters. Dec. 16.

Complete Specifications Accepted.

1899.

1884. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Manufacture or production of new anthraquinone derivatives. Nov. 29.

3186. G. B. Ellis.—From La Société Chimique des Usines du Rhône anciennement G. P. Monnet et Cartier, France. Preparation of eosin and other halogen derivatives of the fluorescein group. Dec. 13.

3539. Read Holliday and Sons, Ltd., J. Turner, H. Dean, and J. Turner. Manufacture of colouring matters containing sulphur. Dec. 20.

3576. J. Imray.—From La Société Anonyme des Matieres Colorantes et Produits Chimiques de St. Denis, France. Manufacture of new substantive black colouring matters. Dec. 6.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Applications.

23,065. A. Mellor. Improvements in or connected with machines for dressing silk and other like fibres. Nov. 20.

23,695. E. Price. A new or improved machine for mercerising cotton yarns and apparatus connected therewith. Nov. 28.

23,729. P. A. Newton.—From C. A. Granguist, Sweden. Improved apparatus for the production of artificial textile fibres. Nov. 28.

24,163. J. F. Copley. Improved combined processes and treatment of cotten or like vegetable fibres in the operations of boiling, purifying, or extracting and bleaching and mercerising. Dec. 5.

24,188. J. R. Ecob. Improvements in apparatus for mercerising fabrics and the like. Dec. 5.

24,234. E. Goldschmidt. The manufacture of a new fabric. Dec. 5.

24,237. H. E. Aykroyd and P. M. Krais. Process for treating dyed fibrous material. Dec. 5.

24,464. H. E. Aykroyd and P. Krais. Improvements in the treatment of cotton and other cellulose fibrous materials and fabrics. Dec. 8.

24,519. A. M. Plaissetty. New process for the manufacturing of artificial silk. Dec. 9.

24,625. R. B. Ransford.—From M. Böhler, Germany. Improvements in the manufacture of felt. Dec. 11.

24,665. J. T. Pearson. Improvements in and relating to the method of conditioning or treating yarns and other fibrous substances and machinery, and appliances therefor. Dec. 12.

24,943. J. A. Bolton. Improvements in or relating to the treatment of wool, woollen yarn, woollen fabrics, and other woollen goods. Dec. 15.

Complete Specifications Accepted.

1898.

25,757. E. Edwards.—From F. Gatzsche, Germany. Floorcloth and method of manufacturing the same. Dec. 6.

1899.

1514. E. Robinson. Apparatus for drying wool, textile, and other substances. Nov. 29.

2211. F. S. Holland and J. J. Jackson. Apparatus for treating yarns with mercerising or other liquors. Dec. 13.

3113. V. F. Feeney.—From L. Schreiner, Germany. Fabric and method of making the same. Dec. 13.

4170. T. Bold. Apparatus for treating yarns with liquids. Dec. 6.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Applications.

24,275. J. C. Butterfield. Improvements in bleaching paper, wood pulp, straw, or peat, suitable for the manufacture of paper pulp. Dec. 6.

24,455. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. A method of dyeing with sulphur dyestuffs. Dec. 8.

24,722. M. de Kasperski and L. Morren. A new or improved process and apparatus for dyeing textile fibres in loose, spun, or woven state. Dec. 12.

24,932. J. A. Bolton. A new or improved method or process of cleaning or dyeing wool, woollen yarns, woollen fabrics, and other woollen goods. Dec. 15.

Complete Specifications Accepted.

1898.

25,823. J. Rhodes. Preparing and dyeing of tops, slubbing, wool yarns, silk, mohair, alpaca, jute, or any other textile fabrics. Dec. 13.

1899.

1973. C. Smith, W. Smith, J. Hodkinson, and J. Chorley. Apparatus for treating textile yarns and fabrics prior to sizing, dyeing, scouring, filling, or the like. Dec. 20.

1974. C. Smith, W. Smith, J. Hodkinson, and J. C. Chorley. Treating textile fabrics prior to sizing, dyeing, scouring, filling, or the like. Dec. 6.

2708. H. Newell. Machine for dyeing, bleaching, wetting-out, and semi-mercerising piece goods. Dec. 20.

21,090. O. Gruhne. Centrifugal dyeing machinery or apparatus. Dec. 6.

21,489. L. Weldon. Machines for use in dyeing yarns. Dec. 13.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

23,303. C. F. Cross. Improvements in the production of alkali, cellulose, and allied compounds. Nov. 22.

23,322. J. Swinburne and E. A. Ashcroft. *See* Class X.

23,323. J. Swinburne and E. A. Ashcroft. *See* Class X.

23,340. R. Haddan.—From P. J. J. Roubertie, France. Process of manufacturing potash, soda, chlorine, and their derivatives by the decomposition of the alkaline chlorides, and apparatus therefor. Complete Specification. Nov. 22.

23,641. B. J. B. Mills.—From L. Michaud, France. A process for the regeneration of carbonate of baryta resulting from the manufacture of oxygenated water. Nov. 27.

23,664. O. Meurer. Process for obtaining ferric sulphate and metal sulphates from iron pyrites and other sulphide ores. Nov. 27.

23,731. G. H. Quelch and T. O. Kent. Improvements in the preparation of masses containing carbide of calcium for use in the generation of acetylene gas. Nov. 28.

23,783. J. Hargreaves. Improvements in the manufacture of sulphates and metallic oxides. Nov. 29.

24,011. J. Grossmann. Improved method of producing alkali cyanides and ferrocyanides. Dec. 2.

24,307. T. Wilton. Improvements in the manufacture and purification of alkaline cyanides. Complete Specification. Dec. 6.

24,748. G. W. Johnson.—From the firm of Verein Chemischen Fabriken in Mannheim and A. Clemm, Germany. Improvements in the manufacture or production of sulphuric anhydride and means to be employed therein. Dec. 12.

24,876. W. P. Thompson.—From P. P. H. Macé, France. Improvements in and in apparatus for the manufacture of mangano calcium carbide without the use of electric current. Dec. 14.

Complete Specifications Accepted.

1898.

26,259. J. Bŭlb. Separation or production of hydrocyanic acid from gases containing such acid or cyanogen. Oct. 4.

1899.

279. G. W. Johnson.—From The Deutsche Gold and Silber Scheide-Anstalt vormals Roessler, Germany. Manufacture of sodium cyanide. Nov. 29.

3185. G. W. Johnson.—From The Verein Chemischer Fabriken of Mannheim, Germany. Manufacture of sulphuric anhydride. Dec. 13.

7107. G. N. Vis. Process for the purification of brine. Dec. 20.

16,935. C. E. Acker. Manufacture of caustic alkali and halogen gas, and apparatus therefor. Dec. 13.

16,947. C. E. Acker Manufacture of caustic alkali and halogen gas, and apparatus therefor. Dec. 13.

16,963. C. E. Acker. Manufacture of caustic alkali and halogen gas, and apparatus therefor. Dec. 13.

21,333. E. Edwards.—From T. Drescher, Germany. Process of preparing peroxide of hydrogen. Dec. 13.

21,871. F. A. Gasch. Process for obtaining zinc solutions free from iron and manganese compounds. Dec. 13.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

28,990. J. Lühne. Improvements in the manufacture of glass and other analogous substances, and in apparatus therefor. Complete Specification. Dec. 1.

24,599. J. Ramboux. Improvements in cements for joining marble, mirrors, china, earthenware, metal, and the like. Dec. 11.

24,797. G. W. de Tunzelmann. Improvements in or relating to the manufacture of highly refractory fire bricks, slabs, crucibles, tubes, retorts, and other earthenware articles exposed to high temperatures. Dec. 13.

Complete Specifications Accepted.

1899.

2679. P. T. Sievert. Apparatus to be used in the manufacture of glass. Dec. 20.

3903. W. W. Pilkington. Machinery for rolling sheets of glass. Dec. 20.

10,962. P. T. Sievert. Manufacture of glass articles. Dec. 6.

10,963. P. T. Sievert. Apparatus for the production of glass articles. Dec. 13.

17,339. O. Imray.—From La Société des Verreries de Bruxelles, Belgium. Process for the total or partial hardening of glass. Dec. 6.

18,587. E. Offenbacher. Process of manufacturing decorated glass, and machinery therefor. Dec. 13.

21,264. C. H. W. Ruhe. Machines for blowing glass. Dec. 13.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

23,458. M. Münch-Phipps. Improvements in fireproof ceilings. Complete Specification. Nov. 24.

23,534. J. M. Thompson. Improvements in the construction of fireproof flooring, and in materials therefor. Nov. 25.

23,535. J. M. Thompson. Improvements in and relating to the preparation of artificial stone for building and like purposes. Nov. 25.

23,583. J. G. Pauchon. Improvements relating to the preservation of wood. Nov. 25.

23,964. C. Czerny and C. Schlimp. Improvements in hydraulic presses for use in the manufacture of blocks of artificial stone and the like. Complete Specification. Dec. 1.

24,070. T. A. Hearson. Improvements in the construction of chambers for drying wood and other materials, and for impregnating them with gaseous fumes. Dec. 4.

24,612. J. C. Sellars. Improvements in the manufacture of building tiles, blocks, and other articles. Dec 11.

24,812. E. Reese. Improvements in connection with the manufacture of blocks, sets, and slabs, from granite, slate, and the like refuse. Dec. 13.

Complete Specifications Accepted.

1898

25,155. S. W. James. Manufacture of artificial marble, granite, and the like. Dec. 6.

25,304. R. Haddan.—From R. Koepp and Co., Germany. Process of manufacturing artificial stones. Nov. 29.

27,327. F. G. Bate, A. C. Oakes, and T. M. Thom. Process for producing artificial stone. Nov. 29.

1899.

1664. G. A. Boisselier and V. C. Laurent. Manufacture of bricks, slabs, blocks, flag-stones, and the like. Dec. 6.

1712. R. C. H. Bonsor and J. Brown. Compound for hardening cements, mortar, pulp, and the like. Dec 20.

1756. P. Davies and E. J. V. Earle. Drying apparatus, applicable for use in the manufacture of Portland cement, and for analogous purposes. Dec. 6.

16,050. C. von Forell. Process for the production of Portland cement from blast furnace slag and lime and the like. Dec. 13.

18,787. W. Owen. Manufacture of artificial stone. Dec. 20.

18,945. G. J. Greundler. Building material. Dec. 20.

20,518. S. Weill. Process for the production of artificial marble. Dec. 6.

20,930. G. de Bruyn. Artificial building stone. Dec. 20.

21,185. M. Dumas. Process for preservation of natural or artificial siliceous, argillaceous and calcareous substances. Nov. 29.

21,814. G. F. Leboida. Process for preserving wood. Dec. 13.

X.—METALLURGY, MINING, Etc.

Applications.

23,322. J. Swinburne and E. A. Ashcroft. Improvements in the treatment of sulphide ores. Nov. 22.

23,323. J. Swinburne and E. A. Ashcroft. Improvements in the treatment of sulphide ores. Nov. 22.

23,313. J. E. Mitchell. Improvements in converters or apparatus to be employed in the manufacture of steel and ingot iron. Nov. 27.

23,678. T. Twynam. Improvements in the recovery of tin from tin scrap. Nov. 28.

23,911. C. J. Head and R. C. Wild. An improved method for the treatment of telluride ores. Nov. 30.

24,123. M. Schmidt und Gesellschaft fur Elektrische Metallbearbeitung G. M. B. H. Improvements in or relating to the joining of pieces or articles of aluminium or aluminium alloy. Complete Specification. Dec. 4.

24,135. J. Gitsham. Improved method or process for the extraction and recovery of zinc from sulphide ores. Complete Specification. Dec. 4.

24,446. C. Barnett. Improvements in charging steel melting furnaces and the like, and in apparatus therefor. Dec. 8.

24,587. L. M. Becker. An improved crucible or smelting pot. Dec. 11.

24,699. W. D. Allen. Improvements in and relating and method of and means for making metallic castings. Complete Specification. Dec. 12.

24,719. S. A. Cosgrave. Improvements in the manufacture of compound ingots. Complete Specification. Dec. 12.

24,751. R. A. Hadfield. Improvements in the casting of steel and in appliances for use in connection therewith. Dec. 12.

21,761. F. C. Blythe. Improvements in the treatment of zinc-bearing complex ores. Dec. 13.

24,809. J. L. Garle and W. Lyle, jun. The manufacture of a new or improved metal or alloy. Dec. 13

24,910 A. E. Muirhead. Improvements in method of casting and handling steel ingots. Dec. 15.

Complete Specifications Accepted.

1898.

26,526. E. J. Clark Crucible for casting lead or like metals under pressure, especially applicable to the formation of secondary electric battery grids or plates. Nov. 29.

1899.

1694. H. H. Grenfeld. Manufacture of alloys of iron, steel, copper, and other metals. Dec. 20.

5225. A. G. Brookes.—From L. Mach, Germany. Alloys of aluminium and magnesium. Dec. 20.

21,137. W. A. McAdams and D. D. Book. Aluminium alloys, and method of casting them. Dec. 13.

21,213. W. A. Koneman and W. H. Hartley. Furnaces for roasting ores and the like. Nov. 29.

21,224. H. J. Haddan.—From A. S. Ramage, United States. Process for obtaining iron oxides. Dec. 13.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

23,235. H. Leitner. An improvement in secondary voltaic batteries. Nov. 21.

23,728. M. Wuillot. Improved manufacture of lead plates for secondary batteries. Complete Specification. Nov. 28.

23,738. The British Thomson-Houston Company, Ltd.—From C. P. Steinmetz, United States. Improvements in compounding electric alternators. Complete Specification. Nov. 28.

23,755. J. D. Darling and C. L. Harrison. Improvements in electrolytic apparatus. Complete Specification. Nov. 28.

23,813. Siemens Bros.—From Siemens and Halske Aktien Gesellschaft, Germany. Improvements in galvanic batteries. Complete Specification. Nov. 29.

23,830. E. Pohl. Improvements in the process of manufacturing carbons for electrical and electro-chemical and other purposes. Nov. 29.

24,058. W. Bein. Improved means for carrying off the gases generated in electrolytic apparatus. Dec. 2.

24,116. A. Perrin. Improvements in electric accumulators. Dec. 4.

24,148. J. Lühne. Improvements in electric furnaces for making glass and other analogous substances. Complete Specification. Dec. 4.

24,230. I. L. Roberts. An improved anode or other electrode for use in electrolysis, and process of making same. Complete Specification. Dec. 5.

24,297. J. B. Relin and C. A. Rosier. Improvements in accumulators. Dec. 6.

24,451. H. H. Lake.—From C. Bruno, Italy. Improvements in storage batteries. Dec. 8.

24,473 W. Majert. Improvements in accumulator plates. Complete Specification. Dec. 8.

24,524. G. Leve and The Monobloc Accumulator Syndicate, Ltd. Improvements in or connected with electric accumulators. Dec. 9.

24,641. W. W. Pilkington and W. R. Ormandy. Improvements in the manufacture of accumulator batteries and in porous cell plates or diaphragms for the same or other batteries, and for other purposes, chemical or mechanical, where an extremely porous or hard material is required. Dec. 11.

24,668. H. M. Punnett and H. M. Punnett, jun. Improvements in or relating to means to be employed in connection with the electro-deposition of metals upon iron and steel. Dec. 12.

24,723. F. E. Hatch. Improvements in the process of smelting ore, and in electric furnaces therefor. Complete Specification. Dec. 12.

24,880. Z. Stanecki. Improvements in the manufacture of accumulator plates. Complete Specification. Dec. 14.

24,960. C. Luckon, jun. A method of producing electrodes for electrical accumulators. Dec. 15.

24,968. B. Jonas. Process for the production of thermo-electric batteries. Dec. 16.

25,011. W. P. Thompson.—From J. P. Fontaine, France An improved primary electric battery. Complete Specification. Dec. 16.

25,012. W. P. Thompson.—From G. Daseking and A. Brandes, Germany. Improvements in electric accumulators. Dec. 16.

Complete Specifications Accepted.

1899.

6687. H. H. Dow. Porous diaphragms for electric cells and methods of producing the same. Dec. 13.

17,337. C. Vogt. Battery cell with double case. Dec. 13.

20,741. A. J. Boult.—From P. Delafon, France. Electric batteries. Dec. 20.

22,384. J. Post. Chemical electrical excitants. Dec. 13.

XII.—FATS, OILS, AND SOAP.

Applications.

23,539. S. Dyson and J. Gaskell. Manufacture of saponaceous products from petroleum or other mineral oils. Nov. 25.

23,618. E. H. Beckett. Improvements in oil separators. Nov. 27.

23,842. J. F. Phillips. Improvements in the preparation of soaps. Nov. 29.

24,835. J. Templeman. Improvements in and relating to the manufacture of cleansing compounds. Dec. 14.

Complete Specification Accepted.

1899.

1010. J. H. Hunter. Apparatus for aerating, purifying, or analogously treating liquids, fats, and similar substances. Dec. 20.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

Applications.

23,233. E. Theisler. An improved process for purifying graphite. Complete Specification. Nov. 21.

23,242. S. Cowper-Coles. Improvements in the manufacture of zinc paint. Nov. 22.

23,799. G. L. Critchley, C. A. Critchley, and J. J. Davies. "Princess enamel." Nov. 29.

24,534. T. Möller. Tar paint. Complete Specification. Dec. 9.

24,743. T. Huson. Improvements in or relating to compounds for destroying or removing old paint lacquer or the like. Dec. 12.

Complete Specifications Accepted.

1898.

25,275. A. J. Boult.—From P. Carré, France. Fireproof paint or composition. Nov. 29.

25,286. C. J. Grist. Manufacture of composition having as a basis oxidised oil, or oxidised oil and a fibrous material. Nov. 29.

1899.

345. H. V. Simpson and The British Non-Flammable Wood Company, Ltd. Fireproof compositions for painting or covering the surfaces of wood or other materials. Nov. 29.

2848. A. J. Smith. Manufacture of varnish. Dec. 13.

3475. G. de Bechi. Production of zinc oxide. Dec. 20.

19,464. H. Schneider. Process for manufacturing a substitute for gutta-percha for coating cables and for other purposes. Dec. 6.

21,224. H. J. — From A. S. Ramage, United States. Dec. 13.

22,337. C. Wegelin. Manufacture of soot or lamp-black from tar and other carbonaceous substances. Dec. 13.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

Applications.

23,062. A. Exley. Improvements in apparatus for treating skins in the manufacture of leather. Nov. 20.

23,377. B. Wright and D. Wright. Improvements in or relating to machines or apparatus for staking, softening, and perching leather. Nov. 23.

24,680. G. W. Adler. An improved process and composition for tawing skins in the manufacture of leather. Dec. 12.

Complete Specifications Accepted.

1898.

26,470. J. Hutchings. Machinery or apparatus for treating hides, kips, or skins for the manufacture of leather. Dec. 20.

26,576. S. L. Johnson, E. Johnson, J. Brooksbank, and A. H. Gibbings. Means or method of and apparatus for removing wool and other hairs from skins. Dec. 20.

1899.

921. J. Dumm and G. H. James. Treatment of hides. Dec. 6.

3111. M. Brunn, O. Srpek, E. Haas, and I. Kornacher. Manufacture of leather. Dec. 13.

5529. F. W. Wartenberger. Process of tanning. Dec. 20.

13,307. L. Consonno. Treatment and tanning of hides and skins. Dec. 13.

19,540. B. Trenckmann. Leather manufactured from the intestinal coats of animals, and gloves made from such leather. Dec. 13.

22,547. F. Arledter and G. Huth. Manufacture of rosin size and apparatus therefor. Dec. 20

XV.—AGRICULTURE AND MANURES.

Applications.

23,970. A. J. Boult.—From E. Richter, Germany. Improved manufacture of blood products for fertilising, alimentary, and other purposes. Complete Specification. Dec. 1.

24,815. J. Villars. Improvements in the manufacture of superphosphates for fertilising land. Dec. 13.

XVI.—SUGARS, STARCHES, GUMS, Etc.

Applications.

23,134. J. Robin-Langlois. Method of and apparatus for refining sugar. Nov. 20.

23,158. J. McNeil and C. McNeil. Improvements in apparatus for evaporating or concentrating saccharine or other crystallisable liquids. Complete Specification. Nov. 21.

23,598. J. McNeil and C. McNeil. An improved process and apparatus for the concentration and crystallisation of saccharine and other crystallisable liquids. Nov. 27.

24,213. A. Vallez and F. Giraud. A process and apparatus for the direct manufacture of sugar powder. Complete Specification. Dec. 5.

Complete Specifications Accepted.

1898.

19,262. E. Shaw. Apparatus suitable for preparing syrup for use in the manufacture of sweetmeats and for condensing, concentrating, and evaporating liquids. Dec. 20.

1899.

20,355. H. Hesche, of the firm "Actien-Gesellschaft für Verzinkerei und Eisen-Construction vormals J. Hilgers." Process of manufacturing crystallised sugar or sugar candy, and apparatus therefor. Dec. 6.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

23,317. M. P. Hatschek. Improvements in the manufacture of bakers' yeast. Nov. 22.

24,061. J. Watts. Certain new or improved means for preventing the waste of beer, stout, and other fermented liquors during fermentation. Dec. 4.

24,846. C. Crepelle-Fontaine. Improvements in and relating to continuous rectification and distilling apparatuses. Complete Specification. Dec. 14.

Complete Specifications Accepted.

1898.

25,101. R. Rückforth. Process of treating yeast or yeast products. Nov. 29.

1899.

539. L. Wardle. Treating spent or used hops. Dec. 6.

835. J. Y. Johnson.—From The Syndicat fur Pneumatische Maelzerei, Germany. Pneumatic malting apparatus. Nov. 29.

1413. P. Callebaut. Manufacture of beer. Nov. 29.

1446. A. Bruce. Apparatus for cleaning beer and other pipes. Nov. 29.

2262. J. Hargreaves. Fretting and easing of beer, stout, and other fermented drinks, and in apparatus therefor. Dec. 6.

3509. L. Briant and W. Adlam. Process of and apparatus for chilling beer preparatory to bottling. Dec. 20.

6348. T Storer and R. McAlley. Treatment of distillery refuse commonly called "pot ale" or "burnt ale." Nov. 29.

22,484. A. D. W. King and J. H. Howell. Process and apparatus for the fermentation of beer. Dec. 20.

XVIII.—FOODS, SANITATION, Etc., AND DISINFECTANTS.

Applications.

A.—Foods.

23,360. Montgomerie and Co., Ltd., and J. Montgomerie. Improvements in and relating to the manufacture of a concentrated extract or food product. Complete Specification. Nov. 23.

23,382. H. J. Blackler and W. T. Burgess. Improvements in apparatus for the preparation of humanized milk. Nov. 23.

22,862A. C. M. Johnson. Improved means for sterilizing and preserving food or other substances. Filed Dec. 12. Date claimed Nov. 16, 1899.

24,801. J. J. Möller. An improved process of and apparatus for preserving food-stuffs and the like, also applicable for disinfecting purposes. Dec. 13.

24,858. M. Bernheim and R. D. A. Claudé. Improved food product. Dec. 14.

24,989. M. M. Hanly. Improvements in and in connection with the preservation of milk for storage and transit purposes. Dec. 16.

B.—Sanitation.

23,209. A. J. Liversedge. Improvements relating to refuse destructors. Nov. 21.

23,971. J. C. Thresh. Improvements in the treatment of sewage. Dec. 1.

C.—Disinfectants.

23,227. I. S. McDougall, F. Howles, and W. H. Yates. Improvements in and relating to preparations for use as fumigants, insecticides, germicides, and disinfectants. Nov. 21.

23,634. J. B. de Alzugaray. Improvements in and connected with the manufacture of disinfecting and antiseptic fluids and compounds. Nov. 27.

24,006. D. W. Fessey and F. M. Timmins. A fumigator for disinfecting and for other purposes. Dec. 2.

Complete Specifications Accepted.

A.—Foods.

1899.

1482. J. R. Hatmaker.—From J. A. Just, United States. Modification of milk casein and its preparation as a food. Nov. 29.

1746. W. L. Bousfield, J. M. Duncan, and L. Shortridge. Food preparations. Nov. 29.

2031. C. Joly. System for the storage of cold, the preservation and transportation of frozen goods. Dec. 20.

B.—Sanitation.

1898.

22,520. H. Desrumaux. Apparatus for purifying water and other liquids. Dec. 6.

1899.

555. J. Delattre. Method of and means for purifying waste and impure waters, particularly such waters as contain greasy matters. Nov. 29.

18,129. L. Hirt. Water-purifying apparatus. Dec. 6.

21,452. L. Gathmann. Apparatus for sterilising water or other liquids. Dec. 6.

21,921. W. R. Hutton, jun. Carbonising and obtaining of products from precipitated sewage sludge. Dec. 13.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

24,002. J. E. Thornton and C. F. S. Rothwell. A new or improved substance applicable as a substitute for celluloid, glass, amber, jet, and other substances. Dec. 2.

24,827. R. J. Yarnold. An improvement in or applicable to the bleaching of paper stuff. Dec. 13.

Complete Specifications Accepted.

1898.

24,600. J. Almond and S. F. Andrews. Method of and apparatus for mixing, beating, and bleaching pulp and other papermaker's materials. Nov. 29.

1899.

5776. L. Capazza. Process of charging and sizing paper. Dec. 20.

19,541. P. S. Sinclair. Conduits in paper-making apparatus for conveying the stuff or pulp. Dec. 20.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Application.

24,644. H. Mehrländer. Manufacture of artificial scents in the form of tablets. Dec. 11.

Complete Specifications Accepted.

1898.

23,611. J. Wilson. A diluted or reduced standardised saccharin. Dec. 13.

27,236. T. R. Shillito.—From J. R. Geigy and Co., Switzerland. Manufacture of aromatic oxyaldehydes. Nov. 29.

1899.

1944. J. C. W. F. Tiemann. Process for separating ionone into the two varieties α- and β-ionone. Dec. 6.

2204. H. Sauvinet. Extraction of perfumes from essences. Dec. 6.

3749. P. Jensen.—From N. Altschul, Austria. Manufacture of medicinal malt liquors. Dec. 20.

XXI.—PHOTOGRAPHY.

Applications.

23,640. M. Bernstein. Process of casting photographic plaster or other substances for the production of stereotypes, pictures, engravings, and the like, flat or raised, and for the reproduction of photos. Nov. 27.

23,685. W. White. Improvements in apparatus for producing or exhibiting colour photographs. Nov. 28.

23,880. C. E. Hearson. Improvements in apparatus for coating photographic films and plates with sensitive emulsions. Nov. 30.

Complete Specifications Accepted.

1899.

887. J. E. Thornton and C.F.S. Rothwell. Photography, and materials and processes connected therewith. Dec. 6.

21,243. W. P. Thompson.—From A. W. McCurdy, United States. Process of and apparatus for developing and fixing photographic films. Dec. 13.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

23,208. J. C. Thompson. Improvements relating to fuses for explosive projectiles. Nov. 21.

23,405. J. Landin and A. Jernander. Improvements in igniting composition for matches. Nov. 23.

23,442. J. Ross and W. D. Cairney. Improvements in explosives. Nov. 24.

23,449. A. Holiings. Improvements in or connected with apparatus for pressing gun cotton into blocks. Nov. 24.

23,853. F. A. Ludlow. Improvements in fog signals. Nov. 30.

23,954. J. W. Fowler. Improvements in detonators. Complete Specification. Dec. 1.

23,969. J. Wetter.—From E. Rubin and H. Korrodi, Switzerland. Improvement in percussion fuses for projectiles. Dec. 1.

24,053. H. H. Lake.—From A. G. Hahre, Norway. Improvements relating to the manufacture of matches and match boxes from wood puip. Dec. 2.

24,147. H. Suschny. An improved combustible composition for matches. Dec. 4.

24,377. L. Wenghoffer. Improvements relating to explosives. Dec. 7.

24,380. J. E. Evans-Jackson.—From U. Alvisi, Italy. Improvements in explosives. Dec. 7.

24,561. L. Morane. Improvements in apparatus for use in the manufacture of gun-cotton and soluble nitro-cellulose. Complete Specification. Dec. 9.

24,921. W. H. Akester and H. H. Price. Improvements in explosive compounds. Dec. 15.

Complete Specifications Accepted.

1898.

23,410. The Electric Fog Signal Syndicate, Ltd., and W. R. Sykes. Explosive signalling apparatus for railways. Dec. 13.

25,838. J. E. Evans-Jackson.—From U. Alvisi, Italy. Explosives. Dec. 13.

26,332. W. P. Jones and H. M. Bates. Match. Nov. 29.

1899.

1698. C. R. Andersson and A. O. Andersson's Fabriks Aktiebolag. Ignition compositions for matches. Nov. 29.

2645. T. C. Henchman. Method and means for nitrating cotton and other organic substances to be used in the manufacture of gun-cotton and other substances. Nov. 29.

18,516. S. Fülöp and M. J. Lackovic. Manufacture of blasting composition. Dec. 20.

PATENTS UNCLASSIFIABLE.

Applications.

23,609. H. D. Fitzpatrick.—From M. A. Hocquet, France. An improved process for the manufacture of artificial or compound cork. Nov. 27.

25,006. F. G. Kleinsteuber. An improved manufacture of plastic materials. Dec. 16.

Complete Specification Accepted.

1898.

13,340. S. B. Earle.—From P. W. Wierdsma and J. Knipers, Holland. Manufacture of a substance or product for use as a substitute for vulcanite, hard woods, or other hard materials, or for any other uses or purposes to which same may be applicable. Nov. 29.

Printed and Published by Eyre and Spottiswoode, East Harding Street, London, E.C., for the Society of Chemical Industry.—p. 8455.

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